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Contributions to Gran Quivira Archeology

Gran Quivira
National Monument
New Mexico

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Contributions to Gran Quivira Archeology

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Contributions to Gran Quivira Archeology

Gran Quivira National Monument / New Mexico

Alden C. Hayes

Publications in Archeology 17

With contributions by Thomas J. Caperton, Richard M. Howard,
Barbara A. Peckham, Charmion R. McKusick, A.H. Warren,
Erik K. Reed, Christy G. Turner II, Nancy Tucker Morris,
G. Richard Scott, Shelia Coyne, R.J. Burch, Joseph Katich, and
Kenneth R. McWilliams

National Park Service
U.S. Department of the Interior
Washington D.C., 1981

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian communities and for people who live in Island Territories under U.S. administration.

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Foreword

Gran Quivira National Monument, one of our nation's most significant archeological areas, was established in 1909 near the geographic center of New Mexico. The site of the largest of the abandoned Salinas Pueblos, its importance to the prehistory of the Southwest has also made it one of the most important cultural areas under the administration of the National Park Service. This report, a cooperative effort of a number of scholars, is the result of excavation and stabilization measures undertaken from 1965 to 1968 to provide an "exhibit-in-place," and to provide visitors the opportunity to learn more about the lifeway of these puebloan people.

Alden C. Hayes, a Park Service archeologist, supervised the project during its first two years as a member of the staff of Gran Quivira National Monument, and in its concluding year while on duty with the Southwest Archeological Center. Others contributing to the report include Thomas J. Caperton, field assistant; Barbara A. Peckham, laboratory curator; Richard M. Howard, a ranger-archeologist at Gran Quivira several years before the excavation; Charmion R. McKuisick, a specialist on faunal identification with the Southwest Regional Office; Christy G. Turner of Arizona State University; and Helene Warren of the Museum of New Mexico.

We are particularly pleased to publish this archeological report by combining traditional printing and the use of microfiche. The pocket at the inside back cover contains a film on which is printed the photographic images of ancient Indian art appearing on kiva and room walls of the Monument. These can be projected on a standard fiche reader, and their use as a supplement to the book is explained in an editor's note. We take pleasure in introducing this method of publishing for reasons of efficiency and economy; we plan to continue and elaborate on the method in future numbers of this series, and thereby to reduce substantially the costs of production.

Russell E. Dickenson
Director,
National Park Service

Editor's Note:

On December 19, 1980, President Jimmy Carter signed Public Law 96-550, which changed the name of Gran Quivira National Monument to Salinas National Monument. The law also authorized the Secretary of the Interior to add 466 acres of land to the Monument, which contains other archeological sites important to the prehistory of the Southwest.

Publications in Archeology

1. Archeology of the Bynum Mounds, Natchez Trace Parkway, Mississippi, by John L. Cotter and John M. Corbett. 1951. (PB 177 061)*
2. Archeological Excavations in Mesa Verde National Park, Colorado, 1950, by James A. Lancaster *et al.* 1954. (PB 177 062)*
3. Archeology of the Funeral Mound, Ocmulgee National Monument, Georgia, by Charles H. Fairbanks. 1956. (PB 177 063)*
4. Archeological Excavations at Jamestown, Virginia, by John L. Cotter. 1958. (PB 177 064)*
5. The Hubbard Site and Other Tri-wall Structures in New Mexico and Colorado, by R. Gordon Vivian. 1959. (PB 230 988/AS)*
6. Search for the Cittie of Ralegh, Archeological Excavations at Fort Raleigh National Historic Site, North Carolina, by Jean Carl Harrington. 1962.

7A. The Archeological Survey of Wetherill Mesa, Mesa Verde National Park, Colorado, by Alden C. Hayes. 1964. (PB 234 542/AS)*

7B. Environment of Mesa Verde, Colorado, by James A. Erdman *et al.* 1969. (PB 234 541/AS)*

7C. Big Juniper House, Mesa Verde National Park, Colorado, by Jervis D. Swannack, Jr. 1969. (PB 234 537/AS)*

7D. Mug House, Mesa Verde National Park, Colorado, by Arthur H. Rohn. 1971. (PB 234 539/AS)*

7E. Badger House Community, Mesa Verde National Park, Colorado, by Alden C. Hayes and James A. Lancaster. 1975.

7F. Skeletal Remains from Mesa Verde National Park, Colorado, by Kenneth A. Bennett. 1975.

7G. Orthopedic Problems of the Wetherill Mesa Populations by James S. Miles, M.D. 1975.

7H. Long House, Mesa Verde National Park, Colorado, by George S. Cattanach Jr. *et al.* 1977.

8. Excavations in a 17th-Century Jumano Pueblo, Gran Quivira, New Mexico, by Gordon Vivian. 1964.
9. Excavations at Tse-Ta'a, Canyon de Chelly National Monument, Arizona, by Charlie R. Steen. 1966. (PB 234 540/AS)*
10. Ruins Stabilization in the Southwestern United States, by Roland Von S. Richert and R. Gordon Vivian. 1974.
11. The Steamboat Bertrand: History, Excavation, and Architecture, by Jerome E. Petsche. 1974.
12. The Bertrand Bottles: A Study of 19th Century Glass and Ceramic Containers, by Ronald R. Switzer. 1974.
13. Investigations in Russell Cave, Russell Cave National Monument, Alabama, by John W. Griffin *et al.* 1974.
14. Casemates and Cannonballs: Archeological Investigations at Fort Stanwix National Monument, Rome, New York, by Lee H. Hanson and Dick Ping Hsu. 1975.
15. Woodland Complexes in Northeastern Iowa, by Wilfred D. Logan. 1976.
16. Excavation of Mound 7, Gran Quivira National Monument, New Mexico, by Alden C. Hayes *et al.* 1980.
17. Contributions to Gran Quivira Archeology, by Alden C. Hayes *et al.* 1980

*These publications are no longer available from the Superintendent of Documents. They are available in microfiche or paper form from the National Technical Information Service. Cite the title and parenthetical code number, and apply for prices to NTIS, U.S. Department of Commerce, 5285 Port Royal Road, Springfield, Virginia 22161.

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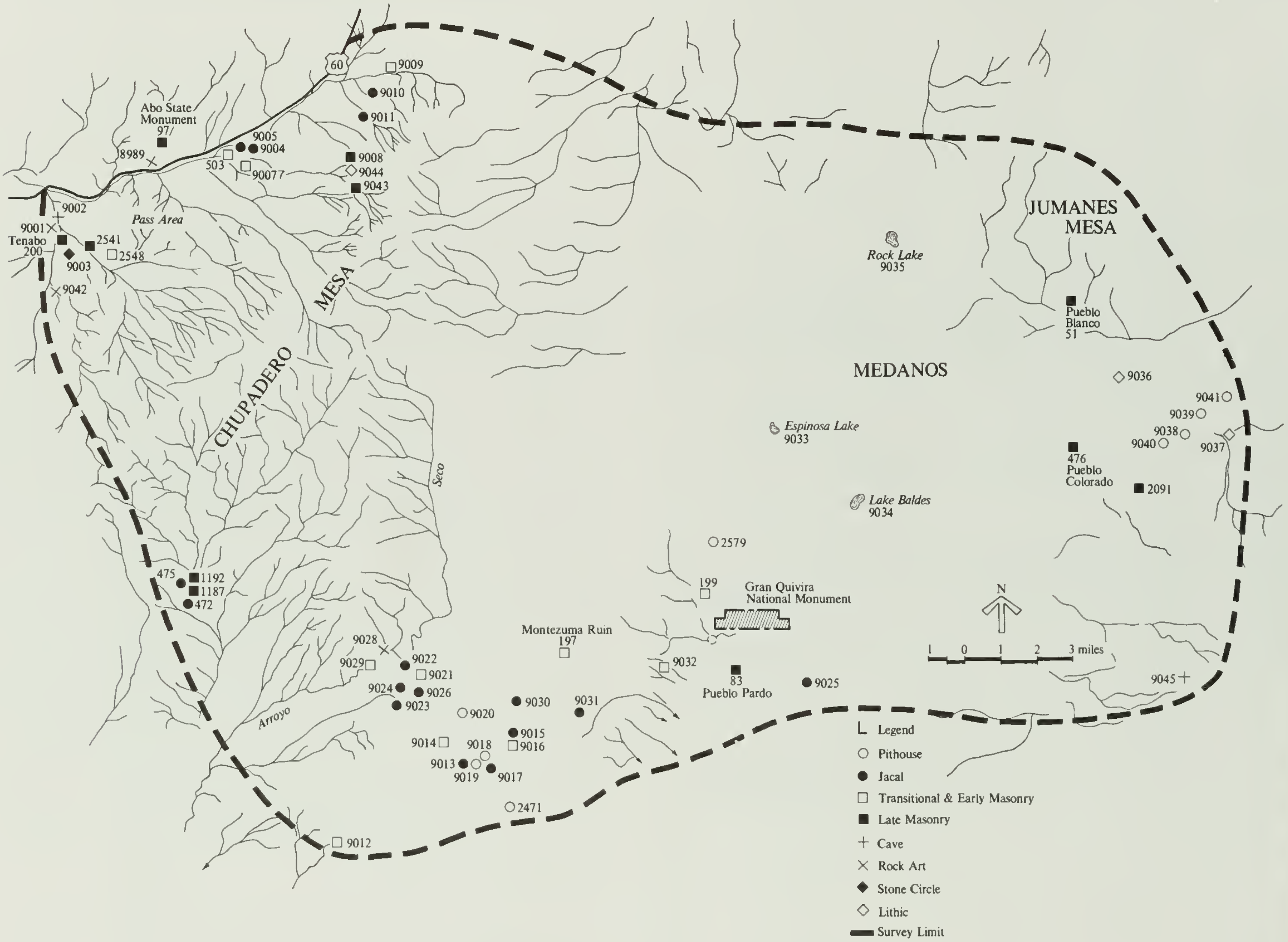
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1 0 1 2 3 miles
9045
Legend
○ Pithouse
● Jacal
□ Transitional & Early Masonry
■ Late Masonry
+ Cave
× Rock Art
◆ Stone Circle
◇ Lithic
Survey Limit

1. Introduction

Alden C. Hayes

In the early days of the Spanish colonization of New Mexico, a group of Indian pueblos was situated in the interior drainage basins east of the Rio Grande, separated from the river by the Manzano and Los Pinos mountains. These villages made up what was known to the Spanish administrators in Santa Fe as the Salinas Province. They occupied the southwest edge of the Estancia Basin in the foothills of the Manzanos, the pass between the Estancia and the Rio Grande valleys, and the north end of the Tularosa Basin to the south. Although there were apparently several more occupied pueblos at the first contact of Spaniard with Indian, they were reduced to seven by the time of the first effective effort to establish missions at about A.D. 1630.

The boundaries of the province, an administrative unit, cut across linguistic lines, and encompassed peoples with some cultural differences. Three pueblos in the Estancia Valley—Chililí, Tajique, and Quarai—spoke Tiwa, the language of the people on the Rio Grande between Isleta and Bernalillo. The others, Abó in the pass and three villages in the Tularosa Basin, were all Tompiros and could be understood by the southernmost of the pueblos—the Piros between Belen and San Marcial on the river. The Tompiros were also divided, in that the three southern Salinas pueblos, separated from Abó and the Tiwas by Chupadero Mesa and Mesa Jumanes, were referred to by the Spaniards as the "Jumanos" pueblos. This term, variously spelled, was never applied to the others. Documents of the time make it clear that the distinction was more than geographic separation.

The historic "Jumanos" towns were Pueblo de Las Humanas at Gran Quivira National Monument, Pueblo Pardo about 3 miles south, and Tabirá, 7 miles to the northeast. Las Humanas and Pardo are on low ridges fingering into the valley off the east slope of Chupadero Mesa, and they overlook the sandy Médanos of the valley to the east. Tabirá is sheltered by a bay at the east end of Mesa Jumanes, an eastward turning extension of the long north-south running Chupadero Mesa. The entire feature, until the recent homesteading period, was known by one name—Sierra de los Jumanos. The distribution of prehistoric settlements in the Chupadero-Mesa Jumanes area is described by Caperton in this volume (Part 2).

Las Humanas was the largest of the historic pueblos, and it was there that Fray Juan Letrado established the mission church of San Isidro in 1629 to minister to all three of the "Jumanos" towns. But the first missionary effort was short-lived, and for many years there was no priest closer than the mission of San Gregorio at Abó. In 1659, however, a new church dedicated to San Buenaventura was built, along with a large *convento*, by Fray Diego de Santander. By 1672, succumbing to the combined pressures of disease and drought, Apache raids, drafts of labor by the church, and the extortionary tributes to the *encomienda* (a grant to a colonist, in return for military service, of the right to tax a specific group of Indians), the Pueblo de Las Humanas was abandoned, its inhabitants seeking refuge in the Piro villages in the Rio Grande Valley. Before the great Pueblo Rebellion of 1680, the last of the surviving Salinas pueblos had followed suit and the entire region remained unpopulated, except for the passage of marauding Apaches, for nearly 200 years.

It was primarily to preserve the impressive remains of the Spanish religious architecture that Gran Quivira National Monument was established in 1909 around the remains of the two churches and the pueblo which they served.

The churches were also the focus of the first archeological work in the area, when Edgar L. Hewett with the School of American Research and the Museum of New Mexico excavated San Buenaventura in 1923 and 1925. Although Hewett did some exploratory digging in the pueblo, it was the partial excavation of Pueblo Pardo in 1941 by Washington and Jefferson College that first brought to light some of the features of the aboriginal archeology (Toulouse and Stephenson, 1960). Additional material came to the fore through the excavation of 37 rooms and a kiva at Las Humanas by the Park Service under the supervision of Gordon Vivian in 1951 (Vivian, 1964). With the dual aim of opening up more of the pueblo for exhibit and gaining more knowledge of the area, the Park Service, from 1965 through 1967, excavated Mound 7—the largest of the 20 houseblocks that made up the village.

The mound, with a maximum depth of nearly 15 feet, was found to consist of three superimposed structures representing three relatively well defined phases of occupation, each with some distinctive traits in association.

The first of these, which we labeled the Early Phase, was characterized by a round masonry pueblo of 150 to 200 rooms built on shallow sterile clay just above bedrock on the crest of the limestone ridge. It was composed of five or six concentric arcs of rooms enclosing a small plaza and a single kiva—a smaller edition of Tyuonyi in the canyon bottom at Bandelier National Monument. Material culture contemporary with the house included trough metates, full-grooved limestone axes, and Chupadero Black-on-white, Glaze A, and corrugated pottery. The phase was dated by inference at about A.D. 1300-1400. Burials were flexed inhumations in the trash.

Nearly contemporary with the first pueblo were four unusual pits dug into bedrock and lined with adobe. An earlier excavation of a similar pit near Mound 7 is reported by Howard (Part 3).

The Middle Phase of construction was less distinct, but was represented by the annexation of a linear block of rooms running west from the southwest quadrant of the original structure. A few rooms of the first house near the point of the abutment of the later rooms were still occupied at this time, but much of the north half of the circle was razed—probably to salvage the building materials. The old rooms closer to the new house were filled with trash. Three kivas were contemporary with the Middle Phase—Kivas K, L, and N. All three were largely subterranean, lined with adobe, and plastered with successive painted layers. The artifact assemblage included trough metates and Chupadero Black-on-white and Glazes C and D pottery. Near the middle of the period the corrugated pottery was supplanted by Corona Plain, and near its termination, Glaze E appeared, along with spiral-grooved fibrolite axes traded from the north. The phase is dated with fair accuracy at A.D. 1400 to the early 1500's. Burial practice remained the same.

For a short period of 15 to 25 years the site was vacant and some timbers were removed, perhaps by people in nearby houseblocks that were still occupied. The Late Phase construction began in 1545 with the renovation of rooms at the west end of the pueblo. At this time the original, round, Early Phase pueblo was buried in trash emanating from the Middle Phase rooms, but in several increments the new house extended over the refuse-buried ruin. By about 1600, it reached its maximum size of about 200 rooms, laid out in a long "F" shape, with the two short arms of the "F" partially enclosing the original plaza. Five kivas were associated with the house, but late in the period they were unroofed and filled with trash. Broken pottery in the trash near the floors indicates that the destruction of the kivas probably occurred at the time of Santander's re-establishment of the mission in 1659. Six rooms near the perimeter of the house, each opposite one of the destroyed kivas, was decorated with one or more layers of painted plaster, and may have concealed a continuation of native religious ritual from the eyes of the priest. Barbara Peckham's study (Part 4) records the mural decoration of the Late Phase rooms and the kivas of the Middle Phase.

Numerous tree-ring dates from A.D. 1545 to 1607 span the period of greatest expansion. Porches were added and a few new rooms were built after 1607, but the materials used were salvaged from rooms which were abandoned. In a trait list for the Late Phase are spiral-grooved axes, carved clay pipes, stone animal fetishes, and slab metates in bins. Tabirá Plain, Black-on-white, and Polychrome replaced Chupadero Black-on-white pottery, but the same brown utility ware of the previous phase was retained. Although Glaze E was still present, Glaze F and Salinas Red, introduced later in the phase, assumed more and more importance. Some of the dead were still buried in the refuse as before, but other remains were cremated and buried below the floors of the rooms. Both inhumation and cremation were practiced simultaneously in about equal proportions.

The sudden introduction of cremation and a new type of black-on-white pottery at a time of renewed building activity suggests an influx of immigrants in sufficient numbers to retain the individuality of their own culture. The retention of the same culinary ware and the old burial customs indicates that the newcomers supplemented, but did not replace, the original inhabitants. The pueblo was finally abandoned in A.D. 1672.

The same conditions prevailed at neighboring Pueblo Pardo. There has been no controlled excavation in the rooms of Tabirá, but ample surface collections contain evidence that Tabirá Black-on-white was that village's dominant decorated ware, leading one to expect that cremation will also be found there.

Archeological evidence, then, corroborates distinctions indicated by documentary sources between the "Jumanos" Pueblos and the rest of the Salines. Petrographic analysis of the pottery temper by A. Helene Warren of the Museum of New Mexico (Part 6) tells us that the red-fired glaze pottery, which makes up 50 percent of the decorated ware in the towns of the Médanos, was imported—in earlier periods from the Rio Grande and the Galisteo, and in the Late Phase largely from Abó and Quarai. Trading, however, was not on a pot-for-pot basis. Tabirá Black-on-white, all of which seems to have been manufactured in the southern villages, makes up a relatively small proportion of the collection from Abó and the towns in the Estancia Valley. To date, no cremations have been found in the northern pueblos.

The allusions found in Spanish records to the singular trade relationship of the Jumanos Pueblos with the wandering hunters of the plains is bourne out by the large quantity of refuse bone found in the trash heaps at Mound 7. Although some of the accumulation may be the result of a greater emphasis on hunting by the people of Las Humanas than was usual among the Pueblos—a possibility open to them because of the propinquity of the game-bearing grasslands—McKusick's analysis of the faunal remains (Part 5) includes evidence of trade with people in the country east of the Pecos.

The remains of 510 individuals excavated from Mound 7 constitute one of the largest collections of skeletal material from a single provenience in the Southwest to be carefully examined. Reports by Erik K. Reed (Part 7) and Christy G. Turner II (Part 8), and students of the latter, are concerned with the anthropometry and microevolution of the population. All of these studies provide added knowledge of the archeology of Gran Quivira. A conventional report (Hayes, 1980) on the excavations at Las Humanas appears as a separate volume in this series.

2. An Archeological Reconnaissance

Thomas J. Caperton

Preamble

In order to better interpret the data coming from the excavation of Mound 7 at Pueblo de las Humanas, it is obvious that an intensive survey of the immediate vicinity would have been helpful. Time and other conditions did not permit so thorough an investigation, however, but it was felt that even a fast-moving and wide-ranging reconnaissance would be useful in understanding the archeological setting.

The area, which covered approximately 480 square miles, included all of Chupadero Mesa from 35° 15' north latitude, north to U.S. Highway 60 at Abó Pass, east across the section of Chupadero Mesa known as Jumanes Mesa, and south to the foothills of the Gallinas Mountains (map 1). Chupadero Mesa is a rough upland covered with a dense growth of juniper and piñon. The southern part of the mesa consists of sandy ridges and small shallow basins, while the south-central area of the reconnaissance includes the Médanos, a sandy plain in the northern Tularosa basin bordered by the Chupadero and Jumanes mesas and the Gallinas Mountains.

September and October of 1967 were spent in the field, the team consisting only of myself and Billy Joe Wells, a rancher near Gran Quivira who was thoroughly familiar with the country. The location of most of the sites recorded was obtained from local inhabitants, and no doubt many sites, particularly the early ones with subsurface architecture, were overlooked; no archaic sites were located.

Sherds were sparse at many of the sites, especially those in the northern area that are easily accessible to amateur collectors. Some sites, in fact, yielded less than 20 sherds. The percentages of such small samples are hardly valid when placed in isolation, but when applied to the whole, perhaps they attain some significance. The collections are recorded in Table 1.

The Pecos classification is not used for site descriptions in this report, for the Gran Quivira area exhibits a lag when compared with the northern Southwest, for which the Pecos system was established. To avoid confusion, the classification used here is based on local architectural manifestations: pithouses, jacals, and masonry structures. Other sites included are caves, water sources, pictographs, petroglyphs, and a historic adobe house (LA:9027), which is not discussed as pertinent to this report.

The Laboratory of Anthropology numbers were used for site designations, and the material collected is stored in Santa Fe at the Museum of New Mexico.

Previous Work In The Area

A total of 22 sites had previously been recorded for the area included in this reconnaissance. The pioneer survey work was done by Adolf Bandelier, who commented on a few sites before the turn of the century (Bandelier, 1892). H. P. Mera (1940, 1943) also located several sites in the Gran Quivira area, particularly to the west in the Jornada del Muerto, during his state-wide survey during the early 30's. Other sites were recorded by Wesley Bradfield, McFarland, and H. Yeo; their reports are on file at the Laboratory of Anthropology, Santa Fe.

Previous excavations in the area have been conducted by Joseph Toulouse (1949) at the Mission of Abó (LA:97), by Toulouse and Stephenson (1960) at Pueblo Pardo (LA:83), 3 miles south of Gran Quivira, and by Vivian (1964) at Gran Quivira. While Toulouse was Custodian at Gran Quivira, he located a few sites in the area and assigned "GQ," or Gran Quivira, designations to them. Earl Green, of Texas Technical College, excavated a pithouse northwest of Gran Quivira (Green, 1955), and in connection with a pipeline salvage operation, another pithouse was excavated by Franklin Fenenga, who also located some other sites (Fenenga, 1956). In 1964, Douglas Scovill and Ronald Ice of the National Park Service excavated an early pueblo at Gran Quivira National Monument (Ice, 1968).

A total of 45 sites were recorded using the Laboratory of Anthropology site numbers 9001-9045. Previous information gathered from that area, from both surveys and excavations, was taken into consideration in arriving at conclusions.

Early Villages

Pithouses

Sites that were interpreted as belonging to pithouse occupations appear as shallow depressions or areas of sparse vegetation. These areas yielded a predominance of brown ware and lithic material.

Pithouse sites previously recorded in the area of the reconnaissance are LA:2471, a site identified by Wesley Bradfield about 8 miles southwest of Gran Quivira, and those sites excavated by Green (1955) and Fenenga (1956). Seven more pithouse sites were located, three of these (LA:9018, 9019, and 9020) in the southern region of Chupadero Mesa, and four (LA:9038, 9039, 9040, and 9041) in the northeast on Jumanes Mesa.

All the pithouse sites were characterized by a high percentage (an average of 65 percent) of Jornada Brown ware (Mera, 1943), along with smaller amounts of various black-on-white sherds. Because there were some differences in pottery between northern and southern sites, the two areas will be dealt with separately.

Black-on-white types associated with the pithouse sites in the southern area include: Puerco (Gladwin and Gladwin, 1931), Socorro (Mera, 1935), Chupadero (Mera, 1931), and Casa Colorada (Mera, 1935), as well as one sherd of Mimbres Bold Face (Cosgrove and Cosgrove, 1932). San Andrés Red-on-terracotta (McCluney, 1962) was also present in the south.

The Jumanes Mesa in the north produced several types found in the southern area: Puerco, Socorro, Chupadero, and Casa Colorada. In addition, the northern area produced Red Mesa (Gladwin, 1945), San Marcial (Mera, 1935), and Kiathuthlana and Mimbres Black-on-white (Gladwin and Gladwin, 1934). Also found in the Jumanes region were Wingate Black-on-red (Hawley, 1936) and a single sherd of Lino Gray (Hargrave, 1932). One sherd of Pinnawa Glaze-on-white (Reed, 1955), another early glaze piece, and two sherds of Corona Plain (Mera, 1935) were found on Jumanes Mesa, but were no doubt intrusive.

If anything could be postulated from such a small sample it would appear that the people of the southern sites did not have as much contact with other cultural areas as the people of Jumanes Mesa. Furthermore, if we are to base a temporal sequence on the limited amount of trade wares, the pithouse occupation in general would be in the range of A.D. 800-1200.

Chupadero Black-on-white was found in association with five of the pithouse sites. While it represented 28 percent of the total wares at LA:9039, at the other four sites it represented 6 percent or less of the total wares collected. It seems that Chupadero Black-on-white, then, made its first appearance toward the end of the pithouse times, and enjoyed a particularly long run until the mid-16th century, when it was replaced by Tabirá Black-on-white. During that time span no appreciable change in either design or paste has been noted. It is possible that the "pithouse sites" with Chupadero were backed by adobe or jacals, which left no surface trace.

None of the pithouse sites were located in truly defensive areas. In the southern area, LA:9019 and LA:9018 were on sandy, scrub-forest slopes leading up from bottomlands, and LA:9020 was on flat land. In the north all the sites of the Jumanes Mesa area were on flats, with the exception of LA:9038 (fig. 1), which was situated on a low ridge that might be loosely conceived as a semi-defensive position. This site yielded a higher percentage of Chupadero Black-on-white than any of the other pithouse sites. Thus, it would seem that at first little thought was given to the vulnerability of location, although defense became a more important consideration during later times.

The water sources for the pithouses of the southern region were probably limited to seasonal ponds or runoff into basins, for today there is no permanent water supply near any of them. And in the pithouse vicinity of the Jumanes region, the only permanent water is a pond or sump (LA:9037) that today is used for livestock. Lithic material appeared in relative abundance around the pond, and sherds found there were contemporary with sherds associated with the pithouses. It seems that the later pueblo occupations in tis area did not utilize the pond, even though two good-sized settlements—Pueblo Colorado (LA:476), and LA:2091—are only about 2½ miles west, and there is no apparent reliable water source near them today.

1. Pithouse area in the Jumanes Mesa region.

The only excavations of pithouses in the area of the reconnaissance were by Franklin Fenenga (1956) and Earl Green (1955), who excavated single units near Gran Quivira. Fenenga found a preponderance of Alma Plain (Haury, 1936b) and Jornada Brown, but he remarked that there seemed to be a close affiliation with the Anasazi people since there was a relative abundance of Lino type sherds. Green's pithouse also yielded Lino sherds in association with the brown wares.

Jacals

The next architectural stage following pithouses in the Gran Quivira area is represented by jacals—that is, sites with upright stone slabs forming room outlines. The walls were probably constructed of vertical wooden posts and adobe, of wattle-and-daub, or of adobe alone. The slab outlines protrude up to a foot and a half above the surface depending on the amount of deposit or erosion.

Two jacal sites were recorded prior to this study, both (LA:472 and LA:475) in the vicinity of the settlement of Chupadero.

The jacals that we found had from one to 10 rooms in each dwelling, and from one to as many as 50 units in a village. The houses are I-, L-, F-, and E-shaped, with the two former shapes the most common. The axes of the houses are generally north-south, and the smaller extensions usually run towards the east. There does not appear to be a standard village plan; rather, a random settlement pattern prevails instead. Comparable structures in the northern Jornada area are usually grouped about plazas (Lehmer, 1948, p. 86).

Jacal settlements are often found in sites that had other occupations, such as pithouses or later masonry structures, with a resultant occupational contamination that affects percentages in the surface collection. For example, LA:9017, a site in the southern area, has both jacal and the earlier pithouse occupations on the same site, and it was impossible to separate the two phases on the surface. The only surface structure was a single I-shaped dwelling; depressions and sherd concentrations probably indicated pithouses in the same area.

Ten jacal sites were found that seemed to be isolated from other occupations. Three of these were located at the northwestern part of Chupadero Mesa on a slope leading up from Abó Canyon, while the rest were in the southern region. No jacal sites were found in the area of Jumanes Mesa—which may suggest an abandonment of this area in favor of the southern and western regions or areas north toward the Galisteo Basin not included in this work. However, evidence of jacal structure may have been obliterated by alluvium or by subsequent masonry occupations.

In the northwest section in the Abó drainage, LA:9005 is made up of two units—one of nine rooms, and the other of two. Only 17 sherds were collected, of which 13 were Jornada Brown, 2 Chupadero Black-on-white, one Lino Gray, and an unidentifiable white ware.

LA:9004 (fig. 2) is made up of five units, while LA:9010 consists of two units. These two sites had a lower percentage of brown ware than LA:9005, and Corona culinary ware was found at both sites. The only trade piece was a sherd of Santa Fe Black-on-white (Mera, 1935) from LA:9004.

The jacals of the southern area (LA:9013, 9022, 9023, 9024, 9026, 9030, and 9031) which yielded more sherds than those in the north, will be treated as a whole here (figs. 3-5). In general, the southern jacal settlements are larger than those of the north and may have as many as 50 units in a village. Trade sherds include Wingate Black-on-red, Socorro Black-on-white, Red Mesa Black-on-white, Klageto Black-on-yellow (Colton, 1932), San Marcial Black-on white (Martin, 1936), San Andrés Red-on-terracotta, Pilares Banded (Dittert, 1959), Los Lunas Smudged (Mera, 1935), Cebolleta Black-on-white (Dittert and Ruppé, 1951), St. Johns Polychrome (Gladwin and Gladwin, 1931), Heshotauthla Polychrome (Kidder and Shepard, 1936), Santa Fe Black-on-white, Galisteo Black-on-white (Mera, 1935), and Poge Black-on-white (Stubbs and Stallings, 1953). These sherds indicate widespread contact with other cultural areas of the Southwest, perhaps as far west as the Little Colorado River and north to the upper Rio Grande. It would seem that the jacal people preferred the north and west as trade areas as opposed to the south.

A rough estimate of the temporal span of the jacal period for the southern sites can be based on the trade wares. Red Mesa Black-on-white was popular around A.D. 870–930, and Wingate Black-on-red about A.D. 950 (Colton, 1953), but both types probably persisted into later times. Mancos Black-on-white ran from 975 to 1075 (Hayes, 1964), San Andrés Red-on-terracotta from 1100 to 1300 (McCluney, 1962b), Santa Fe Black-on-white from 1225 to 1300 (Colton, 1953), Poge Black-on-white from 1325 to 1350 (Stubbs and Stallings, 1953), and Heshotauthla Polychrome from 1300 to 1400 (Smith, Woodbury, and Woodbury, 1966).

The time span represented by the trade wares, and the high percentages of Jornada Brown ware at some of the jacal sites, indicate that both jacal and pithouse architecture were in use at the same time during the early jacal stage. This range, possibly

2. Remains of jacal structures in the Abó Pass area.

4. Jacal ruins at LA:9014 in the southern area.

3. Standing slabs at LA:9013 in the southern area.

5. Jacal structure at LA:9024 in the southern area.

from 1175 to 1350, also overlaps the period of the early masonry structures.

A new ceramic development of the jacal period was the appearance of Corona Corrugated ware, which eventually replaced Jornada Brown. The average percentage of Corona Corrugated on the jacal sites is 7 percent, and Corona Plain 2 percent. The Corona Plain sherds are probably fragments from smoothed areas on corrugated vessels, since this type did not appear until late masonry times. The average percentage of Jornada Brown in the jacal sites was 17 percent, a substantial decrease from the pithouse percentage of 66 percent. Chupadero Black-on-white, on the other hand, shows an increase on jacal sites, where the average percentage is 30 percent, compared with 6 percent in the pithouse occupation. Mera believed that Chupadero Black-on-white made its first appearance with the pueblo forms of villages, and that the appearance of black-on-white pottery, simultaneous with architectural change, may have been the result of pueblo-dwelling people of Tanoan linguistic stock beginning to drift southward (Scholes and Mera, 1940). In any case, whether the transmission of ideas was by diffusion or by migration, there was certainly a change in material culture about A.D.1100.

Along with the ceramic and architectural changes, potential for defense became a more important consideration in the location of settlements. Four of the 10 jacal sites were on ridges, which might be considered semi-defensive position, while other jacal sites that were located on the same sites as later masonry structures were built in obviously defensive positions.

Only one jacal site was found east of Gran Quivira. This site (LA:9025) was at a lake 2 miles southeast of the monument. Sherds collected ran from Jornada Brown to Agua Fria Glaze-on-red and San Lázaro Glaze-polychrome (Mera, 1933). The latter sherds, however, could have been dropped by later people from Gran Quivira.

Transitional Structures

The jacal went through an architectural evolution into full-blown masonry structures by passing through a transitional stage in which either crude masonry footings were inserted between the slab bases and the wattle-and-daub construction, or stones were added to adobe to form walls of a conglomerate nature. Half-jacal–half-masonry structures appear at some sites that also have early structures built completely of masonry (LA:9012, 9016, 9021, and 9032). Such ruins appear as low mounds of rubble with some upright slab bases exposed.

Site LA:9015 plainly exhibited this particular manifestation, for on the same site there were both the early jacals and the later development of half-jacal–half-masonry construction, or "transitional masonry." Less than 200 yards from LA:9015 was another site, LA:9016 (fig. 6), which was a transitional masonry house alongside a true masonry pueblo. Thus, in these two sites, the complete sequence of architectural development can be seen. Trade wares at LA:9015 (the earlier site) included St. Johns Polychrome, Heshotauthla Polychrome, Lincoln Black-on-red (Mera and Stallings, 1931), and Galisteo Black-on-white. At LA:9016 (the transitional and late masonry site), the trade wares were Kana'a Gray (Hargrave, 1932), El Paso Polychrome, and some Glaze A sherds. Using these sherds as a time indicator, and dismissing the single Kana'a sherd, the evolution in architecture probably took place shortly before A.D. 1300. This transition, which was probably a rapid one, is seen only in the southern district.

The use of the upright slab was continued into much later times as a base for walls. This is seen at Mound 7 of Gran Quivira (fig. 7). Although there is no structural rationale for the slab base under coursed stone, it probably represents a vestigial trait retained from an earlier period.

Masonry Pueblos

Early Masonry Structures

The next architectural stage of the Gran Quivira area is that of the early masonry structures showing definite village planning. Glazed pottery first appears on these settlements, but the architectural form was introduced in late pre-glaze times.

Seven early masonry villages were located by the Gran Quivira reconnaissance, three of which were recorded on previous surveys in the area. One of the three, LA:2541, was not revisited, but all the others are rectangular units with a central plaza, some with outlying house blocks (fig. 8).

Mera (1935) believed that the pueblos of the Gran Quivira area do not show a full realization of a symmetrical well-balanced grouping of housing units. The early pueblos, however, do have a definite village plan when it is realized that jacal structures often in association with early masonry structures are not of the same occupational phase. Even the late ruins of Pueblo Colorado (LA:476) and Pueblo Blanco (Tabirá, LA:572) show planned construction.

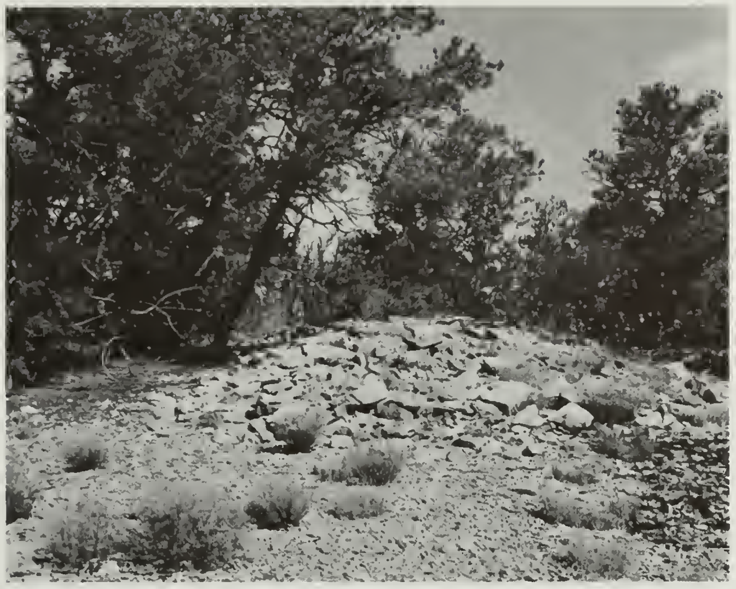
All the early masonry structures of the southern district, with the exception of LA:199, are associated with jacal structures. Those sites on which early glaze wares are found are all of a single occupation. No early masonry sites were seen in the Jumanes Mesa area.

Turning first to the southern sites: Montezuma Ruin (LA:197) was occupied during Glaze A times, but Black-on-white wares predominated (Mera, 1940). This ruin, which is about 2 miles southwest of Gran Quivira, is situated near a permanent spring, the only reliable natural water source in the area today. It is made up of a large central unit with a plaza and some outlying house blocks.

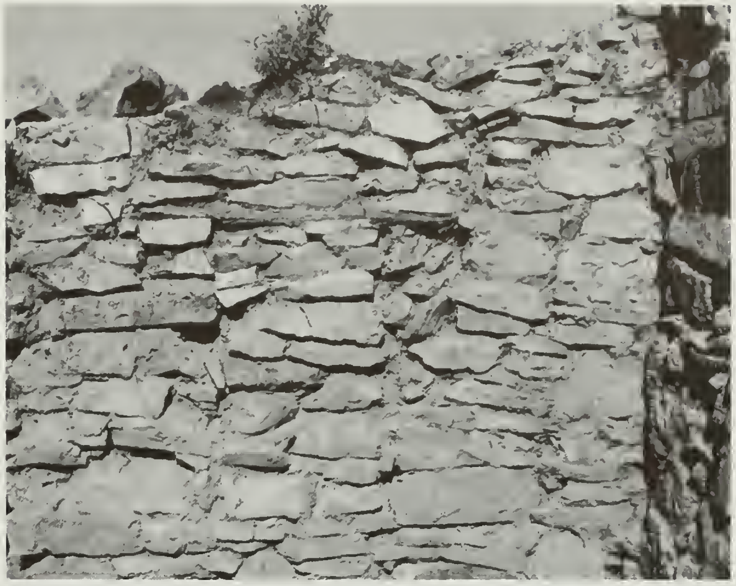
LA:199, located about a mile northwest of Gran Quivira, was occupied about the same time as Montezuma Ruin (Mera, 1940). Consisting of a simple rectangular unit with a large central plaza (fig. 8a), it seems to be the only early masonry structure of the southern area that did not show evidence of earlier jacal structures on the same site.

Lost Ruin (LA:9012) has a large central unit with a plaza and central kiva, in addition to four outlying house blocks. Three kiva depressions were noted outside the central unit. The site was occupied up to Glaze A times, and like the other contemporary sites of the southern region, it is surrounded by earlier structures. Lost Ruin is situated on a ridge and flanked by arroyos. In the immediate vicinity there are several sumps that form lakes after a rain (fig. 8b).

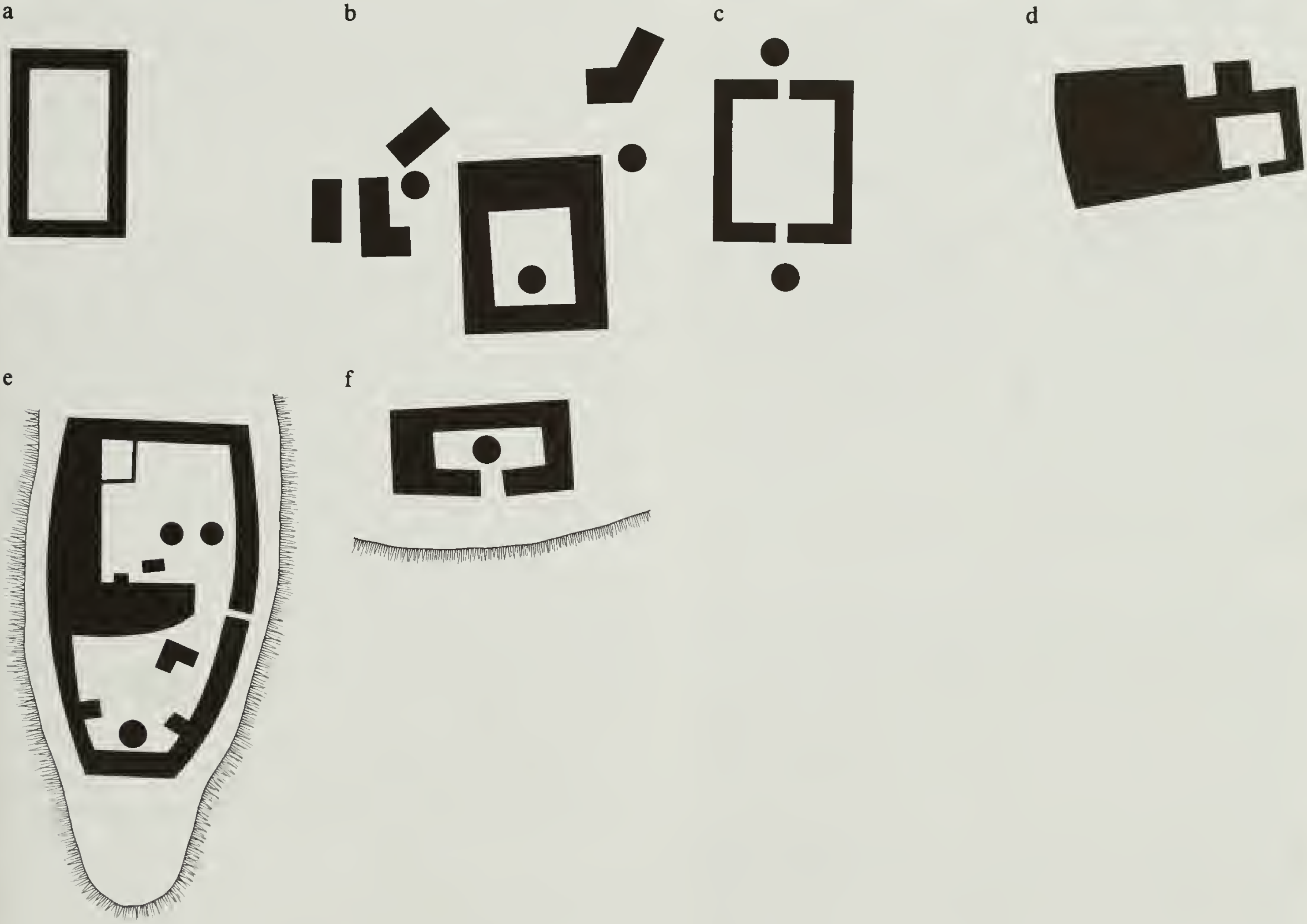
LA:9014, which has a large rectangular central unit similar to LA:9012 and one outlying house block, is in a good defensive position on Turkey Ridge overlooking farmland to the south. A sump to the east of the site no doubt provided water after a rain. It, too, was occupied into Glaze A times.



6. A transitional jacal-masonry structure at LA:9016.



7. Slab-based wall at Mound 7.



8. Ground plans of early masonry structures.

LA:9016 has the large central unit with enclosed plaza, with one outlying house block opposite an opening at the southeast corner. The north and west quadrants were apparently two stories in height. It is situated in an excellent position for defense on the west end of Turkey Ridge. (This site was also discussed with transitional masonry.)

LA:9021 (Axtell Ruin) is the only masonry village located on this survey that was situated on level, open ground. It consisted of a single unit with a large central plaza, with openings to the north and south leading to kivas outside the compound. The village was probably abandoned during early Glaze A times (figs. 8c and 9).

LA:9029, or the Seco Ruin, was first surveyed by Toulouse and numbered GQ 6 (Toulouse and Stephenson, 1960). It is a long rectangular ruin on the spur of a mesa overlooking Arroyo Seco (fig. 8e), with the walls standing as high as 8 feet in places. No glaze sherds were found, and the Seco Ruin is the only early masonry pueblo in the southern district where Chupadero Black-on-white is the latest ceramic type.

LA:9032, located on a sharp ridge about 2 miles southwest of Gran Quivira, is made up of a single large houseblock with a small, enclosed plaza in the southeast corner (fig. 8d).

Turning next to the northern sites: LA:503 is a large ruin in the vicinity of Abó Wash in the northwestern area of Chupadero Mesa. It also has earlier jacal structures, and is apparently the only site in the northern area where that combination occurs. This is also pre-glaze, Chupadero Black-on-white site, as unique among the northern sites as Seco Ruin was in the south—all other early masonry sites produced Glaze A pottery.

LA:9007 is situated near the pass about 2 miles east of Abó. Roughly rectangular in shape, it has a central plaza and kiva with another kiva depression to the northeast of the ruin. There is an opening to the southeast. The site is in a position that might be termed semi-defensive, on high ground above a river bottom.

LA:9009, located about 3 miles southwest of the town of Mountainair, is on the south rim of a high mesa overlooking farmland in the valley below (fig. 8f). Like the other masonry ruins of this period, it is rectangular with a central plaza and kiva.

LA:2541 is located near Tenabó (LA:200) in the northern section of Chupadero Mesa. It was occupied in Glaze A times and is made up of three masonry units and a kiva.

The early masonry settlements have a continuity in plan: they consist of rectangular units around a plaza; there is generally a kiva depression in the plaza; and openings are usually to the southeast corner. Sites LA:9007, 9014, and 9016 each had a kiva depression to the northeast of the pueblo, in addition to one in the plaza. All but two of the early masonry villages were oriented to the east, with the long axis running north-south; the two exceptions are LA:9009 and 9014, in which the long axis was east-west because of terrain.

Numerous trade wares were found at the early masonry sites in the southern district: Red Mesa Black-on-white, Kana'a Gray, Chaco Black-on-white (Hawley, 1936), San Andrés Red-on-terracotta, Wingate Black-on-red, Tularosa Black-on-white (Kidder, 1924), El Paso Polychrome, Los Lunas Smudged (Mera, 1935), Lincoln Black-on-red, Heshotauthla Polychrome, St. Johns Polychrome, Santa Fe Black-on-white, Agua Fria Glaze-on-red (A.D. 1315), and San Clemente Glaze-polychrome (A.D. 1385) (Mera, 1933). It must be remembered, however, that this sampling is contaminated from the earlier occupations which were at all of the southern sites, and therefore any temporal projections must take this factor into account. The trade wares at the northern sites are more accurate time indicators of the settlements of this period, for these sites were of a single architectural phase. The sherds include St. Johns Polychrome, Poge Black-on-white, and some unidentified sherds of the Mesa Verde tradition, which would put their occupation somewhere around A.D. 1300.

No Jornada Brown pottery was found at the northern sites, and the disappearance of the brown wares corresponds with the abandonment of the Jornada Branch of the Mogollon just after A.D. 1300 (Lehmer, 1948). At the multi-occupational sites of the southern area, however, Jornada Brown averaged 8 percent of the sherds, and Corona Corrugated 16 percent. (In the northern area, where there was no brown ware, Corona Corrugated was 27 percent.) Chupadero Black-on-white reached its apex at this time, representing 42 percent of the total combined wares in the southern region, and 50 percent for the northern sites. In addition, glazed ceramics made a significant appearance at this time.

It would seem that during late jacal and early masonry times more thought was given to the vulnerability of settlement location than at other periods. Of all masonry sites in the southern area, only one, LA:9021, is not located on some sort of promontory; too, all villages also had the earlier jacal settlements on the same site. The early masonry sites of the northern section were in defendable positions, as well. Mera (1940) observed that the defensive sites in the Jumanes Mesa area came into being during glaze A times.

Late Masonry Structures

Nine villages of late masonry structures (those occupied after Glaze A times) are in the area of the reconnaissance, two of which (LA:9008, 9042) were located during this work.

Three villages are in the Jumanes Mesa area. First is Pueblo Colorado (LA:476), a large pueblo with three distinct plazas (fig. 10a), which was occupied from Glaze A to E times (Mera, 1940). Next, LA:2091, located on a mesa point above Pueblo Colorado, was occupied during Glaze A and B times (Mera, 1935). And finally is Pueblo Blanco—historic Tabirá (LA:51)—a large pueblo occupied from Glaze A through F times (fig. 10b). The village was known to the early Spanish Colonists, and a small church was built in the center of its plaza (Stubbs, 1959).

Two late villages—Tenabó (LA:200) and LA:2548—have been previously recorded in the Abó area south of the highway. Tenabó, located next to a permanent spring, is a large ruin southwest of the town of Scholle on a low mesa at the fork of two arroyos. Not only are all the Glaze groups from A to F represented here (Mera, 1940), but there is also an abundance of petroglyphs in the area.

The second village is LA:2548, which is located 2 miles east of Tenabó. It is a masonry pueblo with pottery ranging from Jornada Brown to Glaze C (Laboratory of Anthropology Survey).

Two late sites have been located in the vicinity of the settlement of Chupadero in the southwestern section of the area surveyed. First is LA:1187, which was inhabited in Glaze A and B times. Judging from size and the small amount of refuse, it was probably a seasonal occupation (Mera, 1940). The second site, located near LA:1187, is LA:1192, which, according to Mera, was occupied seasonally. Glaze A and E sherds were found (ibid.).

The two late settlements located by the present study—LA:9008 and LA:9043—were situated near Gypsum Spring about 8 miles southwest of Mountainair, at the base of the northwestern edge of Chupadero Mesa. LA:9008, Gypsum Spring Ruin, is made up of three house blocks, which may or may not have been contemporary. A house was built on one of the mounds in the late 19th century (fig. 11). Identifiable sherds included San Lázaro and Puaray Glaze-polychrome dating from 1490+ and 1515, respectively, and Tabirá Black-on-white.

About a mile south of LA:9008 on a narrow ridge is LA:9043, a structure of 13 rooms with walls standing as high as 4 feet. A small plaza opens to the south, where a kiva depression was noted. This settlement shows a definite realization of plan and continuity, which, contrary to Mera's (1935) hypothesis, exists into late occupations in this area. Puaray Glaze-polychrome was the only decorated type of pottery collected. No Jornada Brown or Chupadero Black-on-white was found at either of these sites, in fact, and by this time Corona Corrugated had been completely replaced by the smooth variety.

A work site (LA:9044) existed at Gypsum Spring between LA:9008 and LA:9043. The area was littered with flakes, and the sherds found there were contemporary with the two sites. In places an aboriginal trail could be followed from LA:9043 to the spring, and although the footpath itself no longer exists, a definite area of sparse vegetation in an otherwise heavily brush-covered area wound its way directly from the site to the spring.

Lake and Spring Sites

Sherds were found at Espinosa Lake (LA:9033), Lake Baldes (LA:9034), and Rock Lake (LA:9035), which are situated on the sandy rolling plains north of Gran Quivira. Today, Rock Lake is the only one of the three with a year-round water supply. No structures were found at any of these lakes, but it is possible that any habitations that once existed are now covered by sand. There was an abundance of lithic material at all the sites, but Espinosa Lake yielded a number of basin metate fragments, along with other grinding implements. Sherds found were from all periods—from Kana'a Gray, Corona Corrugated, Casa Colorada Black-on-white, and Chupadero Black-on-white to some unidentifiable red wares of the glaze period.

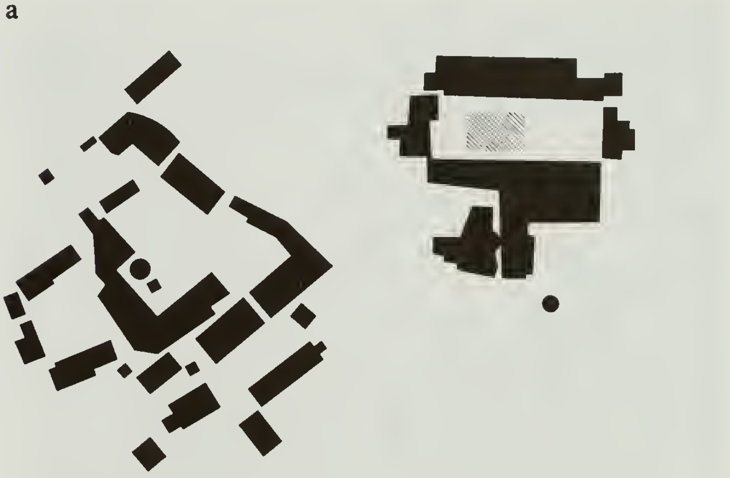
A spring located a mile and a half south of Pueblo Blanco was once undoubtedly an important source of water during its habitation and during earlier times. According to local informants, however, the spring went dry in the mid-1940's and is now covered with sand. Although petroglyphs have been reported around the spring, none were found. They are more likely obscured by sand. Sherds found in the area were Jornada Brown, Casa Colorada Black-on-white, Chupadero Black-on-white, and some unidentifiable glaze pieces.

Cave Sites

Two cave sites—LA:9002 and LA:9045—were found. In the Abó Pass area about a mile northeast of Tenabó (LA:200) under the rim of a bluff was the first, LA:9002. It was approximately 5 feet deep and 15 feet wide. The only sign of habitation was some ashy fill and a smoke-blackened ceiling. It could have been used at any time from early aboriginal to historic times.

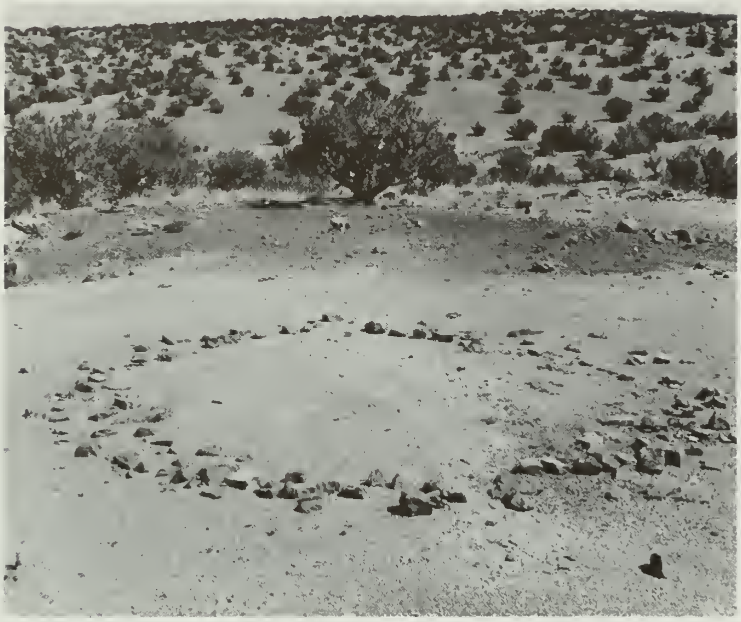
LA:9045 is located in the foothills of the Gallinas Mountains about 13 miles east of Gran Quivira. The cave, which is the

9. Axtell Ruin—masonry structure and plaza.

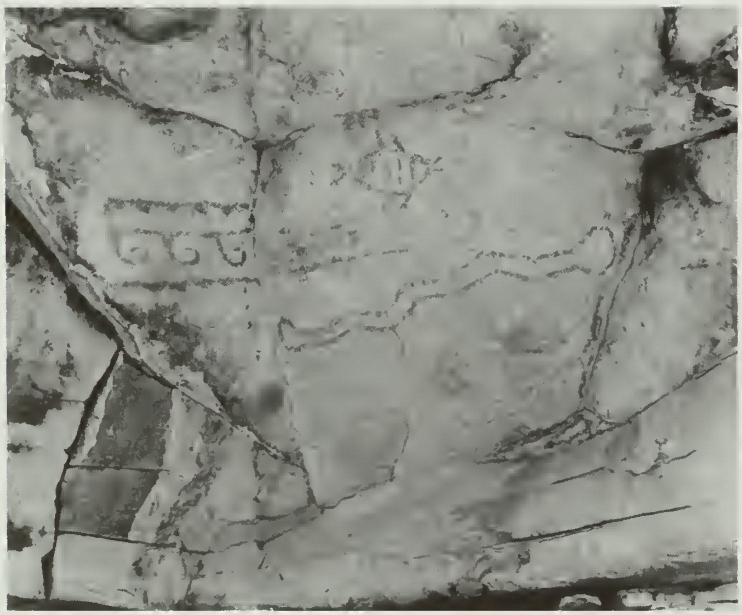


10. Ground plans of two late masonry settlements.

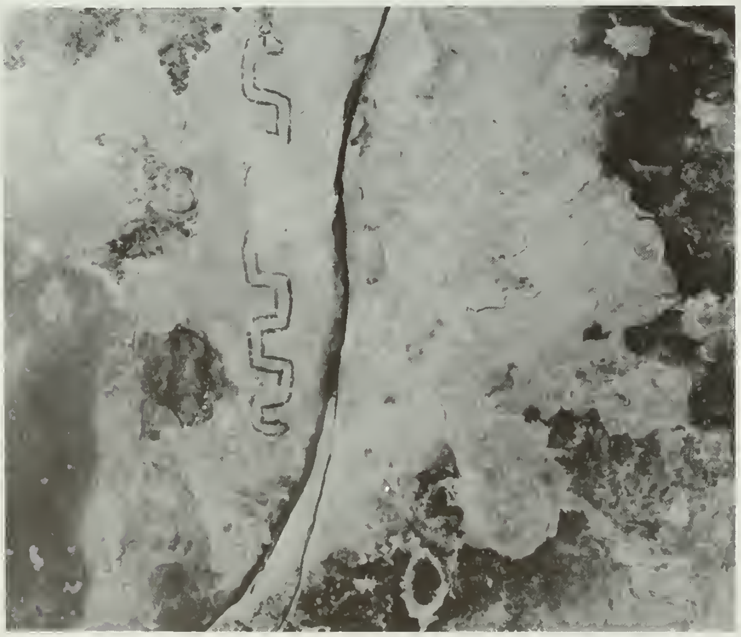
11. Gypsum Spring Ruin, with historic house on top of mound.



12. Stone ring at LA:9003.



13. Pictographs in Seco Canyon.



14. Plumed serpent at LA:9028.

result of a limestone sink, consists of several deep chambers, and its floor was covered with dung. No sherds were found. In the third chamber, however, we did find pictographs of hands rendered in negative design, and petroglyphs were found in a sinkhole outside the cave. Because of lack of equipment, the cave was not fully explored, but local informants claim that several wooden artifacts have been removed from it.

Stone Circles

Seven stone circles of unknown use were found one-half mile south of the large ruin of Tenabó (LA:200). Six were from 4 to 6 feet in diameter, and one, LA:9003, was 18 feet across (fig. 12). The circles consisted of rock outlines, and there seems to be no organization to their arrangement. They were located on a bedrock outcropping on a terrace, with no sign of fire and no cultural depth. Although there were flakes in the area, only eight sherds were collected: a Jornada Brown sherd, one Agua Fria Glaze-on-red, one of a late glaze, and five unidentified red wares.

The circles of stone seem quite like those near Carlsbad in southeastern New Mexico that Mera (1938) described. Although they may possibly be "tipi rings" left by traders from the plains, there is no obvious explanation.

Pictographs and Petroglyphs

Pictographs (LA:9028) were found under a ledge near a permanent water seepage about three-fourths of a mile from the large Seco Ruin (LA:9029). A fish, serpents, and a geometric design were represented, all rendered in a red monotone (fig. 13). One of the snakes (fig. 14) bears some resemblance to the great horned serpent, Avanyu. Snake representations are widespread, appearing frequently in Pueblo symbolism today (Smith, 1952b).

Other pictographs, found about a mile west of Abó on U.S. Highway 60 (LA:8989) and about 2 miles south of Tenabó (LA:9042), were beautifully rendered in polychrome. Human figures and other zoomorphic representations were common. Figures at both LA:8989 and 9042 represented a series of masks or faces that were probably similar to those described by Diego Pérez de Luxan in his account of the Espejo Expedition in 1582. When the company visited what was probably the Pueblo of Tenabó, Pérez de Luxan stated that he saw on each kiva a painted figure of an Indian with a flaming crown (Hammond and Rey, 1966).

The canyon west of Tenabó is covered with hundreds of zoomorphic, geometric, and anthropomorphic petroglyphs (fig. 15a, b, and c). Petroglyphs are difficult to date, however; one of the petroglyphs next to those at LA:9042 depicts what appears to be a figure riding a horse with a spear in one hand, and the other hand on the reins, so at least we know that one figure was done in historic times.

Summary

The first architectural phase of the Gran Quivira area was that of the pithouse, which showed up around A.D. 800. The pithouse occupations were characterized by a high percentage of Jornada Brown ware, but there was also some affiliation with the Anasazi peoples at this time, for some Lino Gray sherds were associated. The Chupadero Black-on-white pottery horizon probably began during the end of this phase.

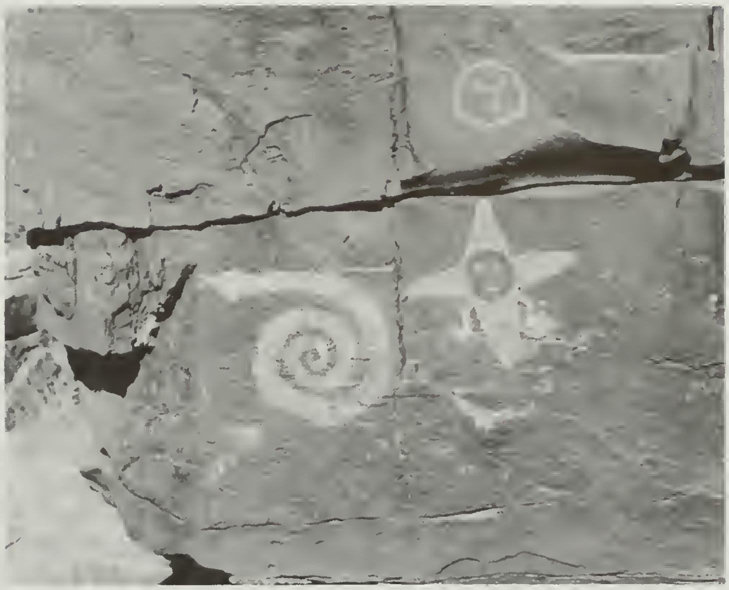
Around A.D. 1100 there was an influx of foreign traits, with corresponding changes in architecture and ceramics. The pithouses were gradually replaced by jacal structures. The village patterns of the jacal villages were sporadic placements of I-, L-, F-, and E-shaped structures of from one to 10 rooms in a unit, and as many as 50 units in a village. This development mainly concentrated in the area southwest of Gran Quivira. The one unique ceramic development of the jacal period was the appearance of Corona Corrugated ware, which began to replace the Brown ware tradition of the pithouses. Chupadero Black-on-white increased.

About A.D. 1200 an architectural evolution started with the addition of crude masonry to the jacal to form a half-jacal—half-masonry structure, which, before the end of the century, developed into full-blown masonry houses. These early masonry houses exhibited the first symmetrical village patterns for the Gran Quivira area. The usual form was a rectangular unit with a plaza, and perhaps an outlying house block as well. During early masonry times the most consideration was given to the defensibility of settlements, a factor that had seen some consideration in jacal times. Corona Corrugated pottery completely replaced the Jornada Brown at about A.D. 1300, contemporaneous with the abandonment of the Jornada and Tularosa basins by the Mogollon people. Glazed pottery made its appearance in the early masonry villages. During the last stages large villages became popular, with less consideration being given to defense. These larger villages became subject to Spanish Colonial domination, however, and the whole area was abandoned shortly before the Pueblo Rebellion of 1680.

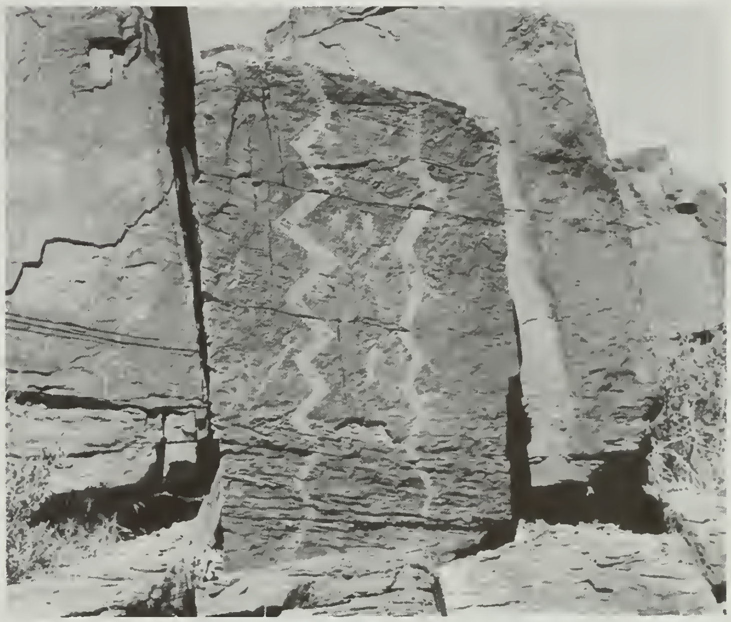
Sites That Do Not Fit

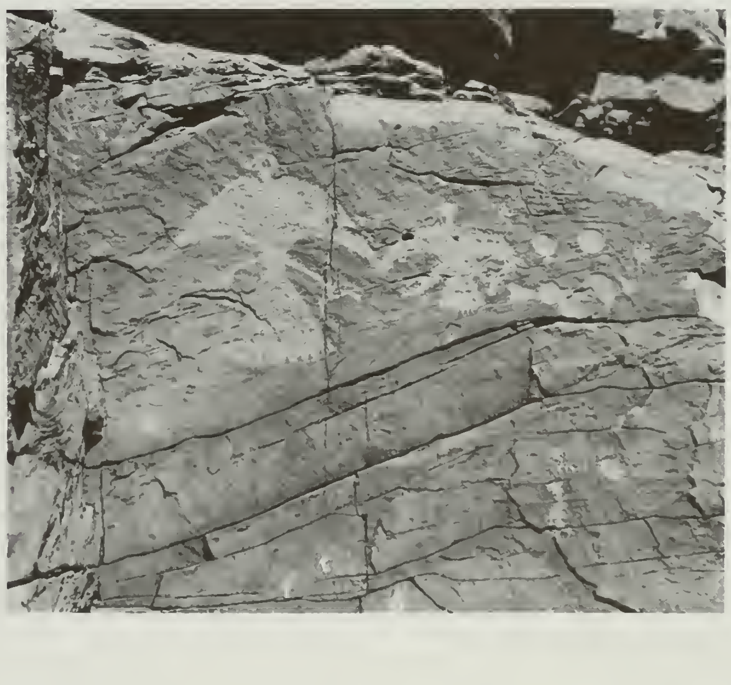
Some sherds were found in the road cut in Abó canyon (LA:9001). There was no evidence of architectural remains, but only some cultural stain in the soil. Large rocks at the top of the cut were decorated with zoomorphic, anthropomorphic, and geometric petroglyphs. The recovered sherds were predominately Corona Corrugated. Possibly the bulk of the site was removed when the road was built.

Another site that was not placed in time was LA:9011. Although sherds were picked up around a pot-hunter's hole near an arroyo southwest of Mountainair, no other archeological remains were in the area. The sherds were Jornada Brown, San Andrés Red-on-terracotta, and some unidentified red-on-brown. This site was probably a pithouse, but there were no surface indications other than the material around the hole.



15. Petroglyphs in canyon west of Tenabó.





16. Photograph of adobe-lined pit.

3. An Adobe-lined Pit

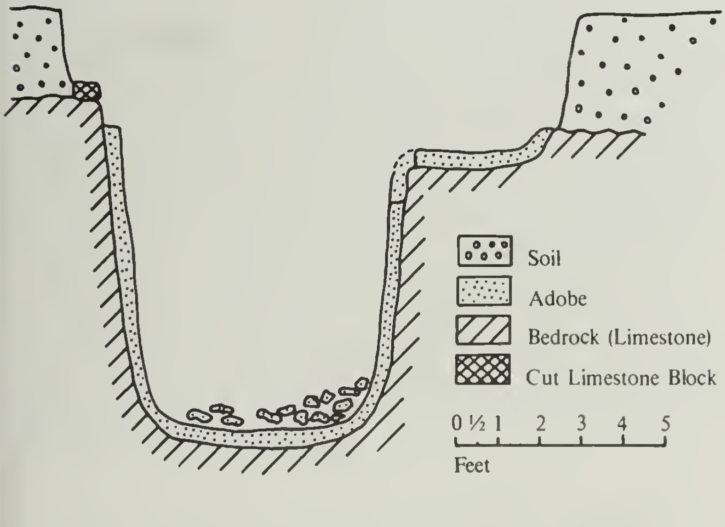
Richard M. Howard

On November 18, 1960, while a portion of Kiva D near Mound 7 was being repaired, an adobe wall was found behind the existing masonry wall of the excavated kiva. Further investigation revealed the presence of an adobe-lined pit, which was excavated, as time permitted, during the latter half of November and early December. Working on the project in addition to myself were Jack Kite and Vernie Wells.

The pit was adjacent to Kiva D; in fact, construction of the kiva after the pit was abandoned had destroyed a small section of the wall. Thus, the pit was more or less at the base of Mound 7, and lay between that mound and the early mission church of San Isidro. (Mound 7, it should be remembered, is the largest house mound at Gran Quiriva and had a long occupation, continuing into Glaze F times.) Much of the pit lies directly under a modern blacktop visitor trail, which was built a few years prior to its discovery.

Except for some slight flattening on the west side, the plan was roughly circular. (The general appearance can be seen in figs. 16 and 17.) The diameter decreased toward the bottom, but an average diameter at a point about 4 feet from the bottom was approximately 6 feet. The depth of the pit was 10 feet below the present ground surface. On the south wall, about 6½ feet above the floor, was a shelf or step, extending about 3 feet into the wall, and measuring about the same distance in east-west diameter. On the same wall, extending downward from the center of the step to within 18 inches of the floor, was a small trough about 1 inch in diameter. Located at intervals along the trough were three roughly hemispherical enlargements, about 3 to 4 inches in diameter.

The entire structure had been dug into bedrock, beginning slightly over 2 feet from the surface, and then lined with adobe. (The term "adobe" as used here refers simply to a packed or hardened mud. Whether the mud was obtained locally or not, I was unable to determine.) The adobe lining extended above the floor from 5 to 7 feet, but the amount of fallen adobe found on the floor indicated that the lining must have originally extended to the top of the bedrock, nearly 8 feet above the floor. The adobe was from 4 to 7 inches thick. At the top of the bedrock, encircling the main pit (but not the recess), was a single tier of stone blocks. The pit gave the appearance of having been well made, for the floor and some of the walls were surprisingly smooth. The adobe wall of the pit intersected the intrusive masonry wall of Kiva D at the north-northeast section of the pit.



17. Profile of adobe-lined pit.

No indication of a roof was found, but the pit was small enough so that if a roof did exist, it could have been made by simply laying local juniper poles across the top. Because of time and money limitations, our excavation was confined to the pit itself, and no further investigation was made beyond the edge to see if additional features were present.

Fill

The bottom 2 feet of fill consisted mostly of fallen wall debris—adobe chunks and large rocks. Above this debris, extending nearly to the surface, was refuse, consisting of numerous animal bones, several hundred potsherds, and a few broken artifacts. The upper foot of fill had been disturbed, and included more recent material. Most of the bones appear to be from larger animals, such as deer or antelope, but no accurate identifications have been made. Since all bones were found above fallen wall debris (with none in the bottom 2 feet of fill), they were therefore apparently deposited after the abandonment of the pit for its original purpose.

Pottery

A summary sherd count is given in Table 2. Except for four Rio Grande Glaze sherds found near the surface, there was no significant difference in the proportionate count of different levels, and only the total count is given here. The Rio Grande Glaze sherds are late (Glazes D, E, and F), and their age is so different from the rest of the sherds in the fill that is can be safely assumed that they had washed down from nearby Mound 7, and had become shallowly buried during construction of the modern trail. Thus, they are not included in the discussion of dates below.

There was not always a clear-cut distinction between Klageto and Heshotauthla sherds, but those assigned here to Klageto were generally orange or tan in color, as opposed to red for Heshotauthla. White-line decoration of Klageto, when present, was broader than on Heshotauthla. At least half of the unidentified sherds are orange or red, and probably represent portions of Klageto or Heshotauthla vessels.

Conclusions

The age of the pit can be assigned to somewhere between A.D. 1250 and 1350, and probably close to 1300. This date is suggested by several factors. First, there were no Rio Grande Glaze sherds found, so the pit must date before 1350—the generally accepted date for the first appearance of Rio Grande Glaze in that area. Second, although Chupadero Black-on-white was abundant, Socorro Black-on-white (a slightly earlier type) was totally lacking. Since Socorro Black-on-white apparently continued in use until 1250 to 1300 (Smiley, Stubbs, and Bannister, 1953), its lack in the pit suggests that the pit could not be much earlier than 1300. This date is reinforced by the fairly common occurence of Heshotauthla Polychrome sherds, a relatively short-lived type that is most abundant about 1300 (ibid.).

The use of the pit remains a mystery. There has been a tendency in the past for the casual observer to identify all depressions and holes in the area as cisterns or reservoirs. To test the likelihood of such a possibility in the present instance, I placed several chunks of adobe from the lining of the pit in a pan of water. Within 10 minutes they had dissolved to a mass of mud at the bottom of the pan. The possibility of the pit serving as a cistern, however, cannot still be dismissed entirely. I may have tried the wrong experiment. During the 1965 to 1968 excavations at Gran Quivira, Hayes (1980) uncovered identical pits. His experiments suggest that the pit possibly could have held water, although for how long is yet uncertain.

Another possibility is that the pit was used for storage. But this theory raises the question of why the Indians would spend so much energy in constructing a pit that was undoubtedly less convenient to use, and more difficult to build, than other architectural styles. The only suggestion that can be offered here is that perhaps they wanted to store something in a cool place in summer or keep it from freezing in winter. However, if something was stored in the pit, no trace of it was found during excavation. The pit did not show signs of firing, and the floor was very clean and smooth, with no ashes or fire marks; neither was there any indication of water-lain deposits.

The pottery found in the pit indicates that it is about 350 years earlier than Kiva D, which it intersects. This, plus the fact that the pit bears no resemblance to a kiva, lessens any temptation to call it a ceremonial structure.

The only feature that does lend itself to interpretation is the shelf of step. Since the floor of the recess showed some use, it was probably a landing used to enter the pit more easily. A 6-foot ladder from the step to the floor of the pit would have been much easier to use than a taller ladder from the floor directly to the surface. However, there were no ladder marks on the floor, and the adobe had fallen away from the edge of the step, where the top of the ladder would have rested. On the other hand, if the pit was used as a cistern, the step would have been a handy spot from which to scoop a pot of water.

Until the discovery of the pit, the earliest feature in the main ruins area was thought to be a low compound, which is characterized by Glaze A sherds, but the lack of Rio Grande Glaze sherds in the pit indicates an even earlier structure. Considering the discovery in 1959 of a predominantly brown ware site at the new residential area of the monument, and more recent pithouse excavations near Park Headquarters by Douglas H. Scovill and Ronald J. Ice (Ice, 1968), I wonder if further investigation in the ruins area would reveal additional features that might be intermediate between nearby Mogollon sites and the large pueblo mounds which now dominate the hilltop.

4. Pueblo IV Murals at Mound 7

Barbara A. Peckham

Introduction

During the 1965 to 1968 excavation of Mound 7 at the Pueblo de las Humanas, a number of examples of prehistoric and early historic layers of decorated and undecorated plaster were exposed. Of the plaster specimens from 74 rooms, 5 kivas, and mixed trash, those from 7 rooms, 3 kivas, and one trash area had murals or traces of paint (table 3).

The murals covered a period of time from the 1400's to the abandonment of the pueblo in A.D. 1672. The dating of the murals was based on the construction and abandonment dates of rooms and kivas, since it was impossible to know when individual layers had been applied or even when the first coat of plaster had been put on a wall. The earlier murals were in kivas K, L, and N, while murals in all of the rooms and in Kiva M were in the Late Phase—the mid-1500's and the 1600's. It is surprising that such a large collection, although fragmentary, came from surface rooms, where deterioration should have been the greatest and preservation least likely.

The methods used for uncovering, recording, and jacketing the plaster were similar to those used at Awatovi and Kawaika-a (Smith, 1952b, pp. 26-37), Kuaua (Bliss, 1948, pp. 220-222; Dutton, 1963, pp. 27-32), Pottery Mound (Hibben, 1960, p. 271), and Pueblo del Encierro (Schaafsma, 1965, pp. 8-10). Only a few additional remarks will be made regarding these methods.

Scraping of the layers was accomplished with a palette knife and a jackknife. The flexible palette knife was the most useful, and its edge and tip could be easily reshaped on a grinding wheel. Usually a straight edge with a blunt rounded end was used.

Because of time limitations and expense, as well as the poor condition of the walls, no attempt was made to preserve the layers by removing them intact. Instead, as each decorated layer was exposed, it was drawn to scale, the characteristics were recorded, and, when possible, the wall was photographed in color. The drawings were made with the use of a grid divided into 2-inch squares and drawing paper with corresponding lines. After the grid was attached to the wall, the location in relation to the reference points was noted, and full- or half-scale drawings made. Edges of plaster, heights of figures above the floor, colors—using the *Munsell Soil Color Charts* (Munsell Color Co., Inc., 1954) and the *Rock Color Chart* (The Geological Society of America, 1963)—order of color application, condition of paint, decoration, redecoration, and so forth, were carefully noted. Once a layer had been fully recorded, it was scraped away to expose the next layer beneath it, and the recording process was repeated. Black and white were not compared with the standard color charts, because none of the recorders could agree on the proper value and hue—black is black, and white is white or off-white.

In addition to the murals many fragments of plaster, decorated and undecorated, were briefly described and recorded in the field notes by the archeologists. These have been listed in Table 3 and, where possible, further described in the text.

The plaster layers were numbered consecutively, with layer one being the outermost and the last layer applied. The "backing layers" were not numbered, since they appeared to have been used only to prepare the wall for a regular coating of plaster. Often these backing layers filled holes that were in older layers, and occasionally they were restricted to a small area. Although the quality of the backing plaster was inferior and showed little finishing or smoothing, it was never discolored by soot or dirt.

To the masonry or trash that formed the building material for a room or kiva, a thick adobe wall-liner was applied in order to finish the structure or the prepare the wall for plaster. Often this liner was left unplastered (table 3).

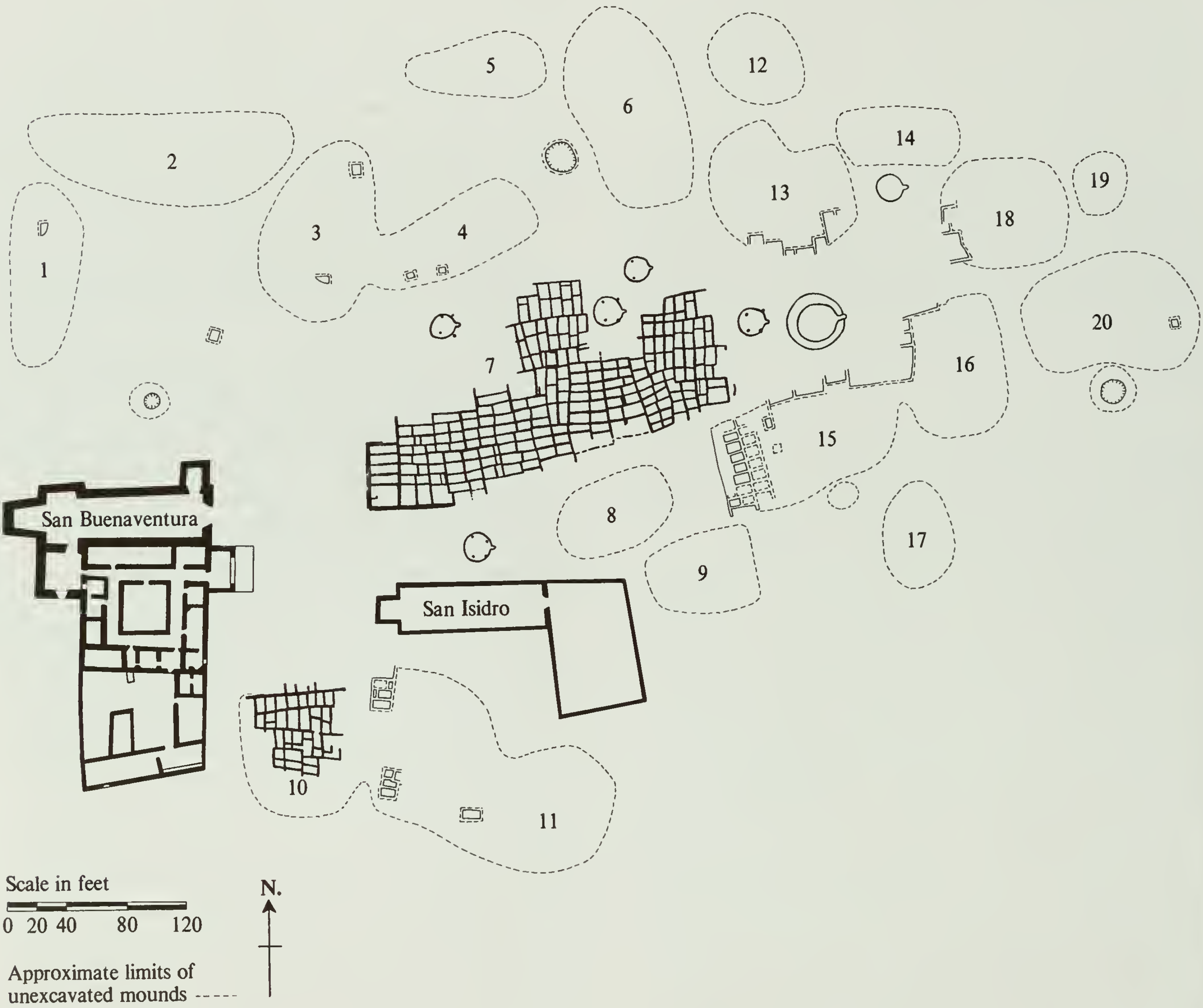
Many layers of plaster will be referred to as "low." These were layers that covered only the lower portion of a wall, leaving an older layer exposed on the upper portions.

Plaster varied in quality from fine-grained and highly polished white gypsum and calcite to a crumbly plaster made from wood ashes, with large chunks of gypsum, charcoal, and other impurities. Most layers were a sandy, friable, brown adobe that lost its surface with rubbing. Samples of plaster and paint were identified by Helene Warren, Curator of Geology, Museum of New Mexico (table 4).

All of the murals were badly cracked and warped, primarily due to burning in Kivas N and K, and water and root action in the surface rooms and Kiva L. Where roots penetrated into the layers, caliche deposits—resembling fine lines of thick white paint—had formed and adhered to the walls. Great care and personal judgment had to be used in separating the root lines from actual murals.

Although most walls at Mound 7 were examined *in situ*, the plaster of two walls of Room 12 were jacketed and removed from the masonry by Gordon Vivian of the Southwest Archeological Center, to be later analyzed, along with numerous small fragments, in the laboratory. The walls were jacketed by applying several layers of tissue paper to the surface of the murals, then daubing the paper with a wet brush before adding the molding plaster, the burlap, and the reinforcing bars. The use of colored paper proved to be a necessity, since it was readily seen against the white dust from the molding plaster; one disadvantage, however, was that the paper tended to discolor some of the paint with which it came into contact. Although we used only several layers of tissue paper, more than three layers would have been preferable, leaving a larger margin for error.

In the laboratory the work of removing the plaster of Paris jacket from the walls was begun with a keyhole saw, a chisel, wire shears, a hammer, a wrench, jackknives, and dental tools—and with as light a touch as possible. This method was adequate but



18. Ground plan, Pueblo de las Humanas.

very time-consuming. A surgical cast-cutting saw proved to be an excellent and quick way of removing the jacket.

After using the surgical saw to cut into the surface of the plaster, the operator made a diagonal cut, toward the original incision, from each side. The resulting loose plaster was then lifted out, leaving a "V"-shaped incision that allowed room for maneuvering and frequent cleaning as the sawing continued. The cleaning was very important, for it allowed the operator to see the yellow tissue paper that was directly on the wall plaster. An indication that one was through the jacket was the sudden ease with which the saw operated.

With this method it was easy to remove the plaster in 7-inch squares. However, a rim was left around the wall plaster to give additional support and to provide a surface to pry against. The paper was then removed, layer by layer (if removed all at once, we found, the pressure or pull broke the wall plaster). Where the tissue stuck to the wall, a damp rag was used to moisten it, and it was then removed with tweezers or by scraping.

In the identification and comparisons of designs, a conservative attitude was maintained. Where possible, alternate identifications have been provided. It should be noted that many of the apparently undecorated layers may have been painted farther up the wall.

Regarding the place of the room murals at Mound 7, Hayes (1980) has speculated that many of the Late Phase rooms served as substitutes for the subterranean kivas because of the influence of the Catholic church. There were no kivas in use in the last years of the pueblo. Many of the rooms had what possibly could be considered as ceremonial objects, and many of the decorated rooms were in the second tier of rooms adjacent to razed kivas (Kiva C, Room 119); Kiva J, Room 205; Kiva K, Room 12; Kiva D, Rooms 148 and 168). Another decorated room (Room 43) was on the south side of the pueblo in the second tier, but was not adjacent to a kiva (fig. 18).

The late Phase started about A.D. 1545 and ended with the abandonment of the pueblo in 1672. Kivas C, M, and J were built during this period, and Kiva K, which was rebuilt in the early 1500's, was used in the early 1600's. Glaze F sherds on the floors, and below some of them, indicate that it was probably Fray Diego de Santander who closed the kivas about 1659. Presumably, then, some rooms became kiva substitutes (Hayes, 1980).

Plaster Descriptions By Layer

Kiva N

The largest collection of murals at Gran Quivira came from Kiva N on the south side of Mound 7. Kiva N, which had a building date of A.D. 1416, was probably burned and abandoned by 1500 (Hayes, 1980). This burning and its immediate filling and covering by up to 7.5 feet of trash probably accounted for the mural preservation.

The kiva, 14.5 feet in diameter, was constructed in trash and limestone and had an adobe wall-liner 0.5 to 1.1 feet thick. This was reinforced with small poles, completely concealed within the adobe, that were set vertically about 0.8 of a foot apart.

Since Kiva N generally had an east-west orientation, we used a series of directional references to describe "sections" of plaster or decorated panels. The use of these terms, however, is approximate; for convenience they were altered slightly here and there from their true directions to conform to their natural separation points.

In addition to the directional areas, we designated 11 reference points, starting with RP 1 on the east-southeast section and extending clockwise to RP 11 on the northeast edge of the ventilator, to correlate descriptions and drawings (fig. 19). Directional and reference point relationships are correlated as follows: northwest, RP 6½ to RP 8; north, RP 8 to RP 9½; northeast, RP 9½ to RP 10½; east, RP 10½ to RP 11½; southeast, RP 11½ to RP 2; south, RP 2 to RP 3; southwest, RP 3½ to RP 4; and west, RP 4½ to RP 5½.

The uncovering of the walls by sections was done because of the problem of completely exposing a given layer at one time. With some sections of wall missing or badly burnt, it was difficult to follow one layer unless it was distinctively marked or colored. Some fragments between RP 11 and RP 2, for example, were so crumbled and warped that work was not done on them unless it could possibly add information to a decorated layer. When these fragmentary areas were uncovered, there was always increased plaster loss due to drying and handling. Because of our sectional method of recovery, special emphasis was placed on any notation that would help in later reconstruction.

Fortunately, the problem of reconstruction was simplified by occurrence of the distinctive Layers 2, 6, 7, 16, 18, 23, and 28, which were so spaced chronologically that they could be correlated by a method similar to dendrochronology. A master chart was made, and the isolated areas matched against this.

Renovation of the kiva did not necessarily mean the replastering of the entire circumference. Occasionally only a section (or sections) or the lower part of the wall had been renewed. This local plastering was most obvious on the east wall, but did occur elsewhere. The only actual points of termination were found on the north and northeast walls (Layers 3, 4, 10, 11, 29, 30, and 31). The fragmentary condition of the other walls prevented our noting layer termination elsewhere. With limited plastering, by section or layer height, several layers were exposed at one time (table 5). Apparently it was unimportant to the occupants if whole or partial design panels from older layers showed through in the renovation.

We began recording murals on the north and east walls, since they were in the best condition. The plaster formed a continuous panel from the northwest section to the ventilator on the east (the area above the ventilator, however, was fragmentary). The southeast and south sections, on the other hand, were in poor condition, and only a few isolated small areas could be salvaged. The southwest and west sections were in good condition, but isolated. The heights of the existing walls were, approximately: northwest, 3.0 feet; north, 2.9 feet; northeast, 4.4 feet; 3.8 feet; southeast, 2.7 feet; south, 3.0 feet; southwest, 3.5 feet; and west, 2.5 feet. The plaster and decorated areas were limited to a smaller space than the existing walls.

A small piece of plaster from the southwest section that fell off the wall as work on the murals was beginning was brought into the laboratory where it was uncovered. The fragment, which measured 0.69 by 0.52 of a foot, was originally located approximately 3.0 to 3.5 feet above the floor. The vertical orientation was determined from the position of the casts of the upright posts that were in the wall. Determining which edges were top and bottom and right and left, however, was speculative.

The various layers on this fragment were correlated to the layers on the undisturbed wall in the same way as the isolated sections of plaster. The first layer on the fragment corresponded to Layer 2 on the wall, and those below could be matched through Layer 26. Behind Layer 26 was the soot-covered, adobe kiva-liner.

With the analysis of this fragment, we had proof that Layers 5, 18, 19, and 23 were definitely "low" layers, that Layers 10 and 11 had not been applied to the southwest section, and also that Layer 14 existed on the southwest section and apparently nowhere else. At this height only Layers 3, 8, and 9 were decorated (the descriptions will be found with the appropriate layers).

Prehistorically, a basal plaster patch encircling the kiva and varying between 1.0 and 2.4 feet above the floor had been applied and repaired numerous times. The patching material was a soft plaster made from wood ashes. In most sections the original layers of plaster were missing, but on the northwest and north walls the patched had been applied over the original layers, which were badly cracked. Unfortunately, it was not possible to uncover these layers. The few instances where repairs could be correlated to the various plaster layers will be noted in the layer descriptions.

On the north and east walls there was a buckle in the plaster immediately above the patch. The lower portion of the wall, at least on the east side, must have posed problems at an early time; Layer 30, the second layer applied in Kiva N, had been repaired, and then the original plaster and the patch redecorated and decorated, respectively.

Layer 1*

Although Layer 1 had been exposed to the fire that destroyed Kiva N, it was in fairly good condition. It was missing from the east wall, however, and sections of the southeast and part of the south walls were so badly burnt that only its presence could be noted.

Layer 1 was a decorated brown adobe with a heavy coating of soot. A black band, 1.2 feet wide and 2.1 to 2.9 feet above the the floor, was visible. Below the band (at RP 7) on the northwest section (fig. 20, see fiche A2) was a large incomplete and irregular-shaped area of spattered white gypsum paint. Farther north, also below the band, were five, scattered, small, thick, white dots, along with a single figure and two pairs—one black quadruped 0.2 of a foot tall, and one incomplete figure.

On the north section, right of RP 8 and on the band, were some faint red decorations. Six dark-red dots formed a circle around an area of missing plaster, with a tapered slash to the right and slightly above the uppermost dot. Another 0.05 of a foot to. the right were more faint and incomplete traces of red paint.

Also on the band, at RP 9, was a single row of dots and vertical lines that continued intermittently to RP 10 on the northeast section. The first group had a pattern of dots and lines: 2/3/3/4/2/. The second group had three dots with a vertical line repeated three times. Both groups were in poor condition and probably once extended further in both directions. The average diameter of the dots was 0.06 of a foot,while the vertical lines ranged in length from 0.14 to 0.06 of a foot.

The southeast and south sections were in poor condition; on the south wall, however, between RP 2 and RP 3, there were the possible remains of four fragmentary white dots on the band. These were approximately 0.03 of a foot in diameter.

Two quadrupeds, an unidentified figure, and a plant above dots and vertical lines were 0.52 of a foot south of RP 3 and 1.35 feet above the floor. All were done in a thick white paint on a black background (fig. 21). Presumably this background was part of the previously noted black band, but its true upper and lower limits could not be determined. The row of dots and vertical lines, which slopes obliquely to the right, consists of a dot, a vertical line, a large dot, six dots, a vertical line, and two dots. Standing on the large dot and above the two adjoining dots were the two quadrupeds facing one another. Over the sixth and seventh dots was a low unidentified and possibly incomplete form. At the western end of this panel was a corn-like plant 0.88 of a foot tall.

On the isolated west section 2.2 feet above the floor were three areas of yellow paint in a horizontal row on a brown background. These had an approximate diameter of 0.3 of a foot but no definite shape; there was no trace of paint in the 0.3 to 0.4 of a foot that separated them.

Below Layer 1 was an undulating band of ash plaster approximately 2.3 feet high, which was visible on the northeast, southeast, south, and west walls. This could have been applied as a backing or as part of the basal patch.

Layer 2

Layer 2—an undecorated, gray ash plaster covered with a thin layer of grime—was recorded on all sections; there is some doubt, however, as to its existence on the lower portion of the southwest wall. Although most ash plasters were only used as backing, the accumulation of dirt and soot on this layer indicated an exposure for a period of time. The surface was smoothed and finished, and the particles of charcoal and gypsum flakes were smaller than usual.

Layer 3

Layer 3 consisted of a decorated brown and gray adobe plaster on all but the east wall between RP 10 and an undetermined point south of the ventilator shaft. On the northeast section, starting 1.04 feet west and continuing to the layer termination point at RP 10, was a row of dots 2.14 feet above the floor. The first four dots, left to right, formed a double row; the rest were in a single row. No vertical lines were present.

A narrow dark red band at the top and yellow band with a squared end began 0.6 of a foot right of RP 2 on the south wall and extended westward to RP 3, where the plaster was broken. Above the band were two white dots. The bands were 1.6 feet above the floor.

A double row of dots, vertical lines, and numerous unidentified forms, which were attached to the dots or isolated between the rows, was 2.19 feet above the floor beginning 0.9 of a foot

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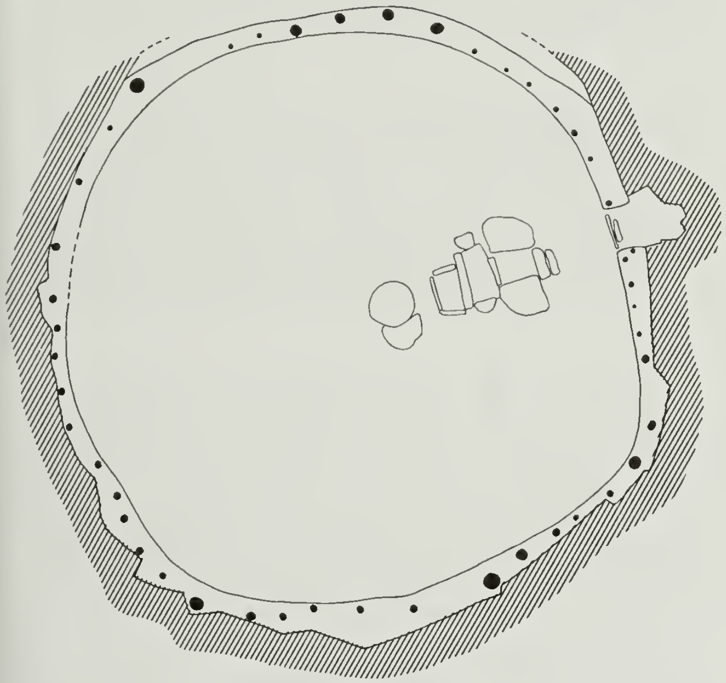
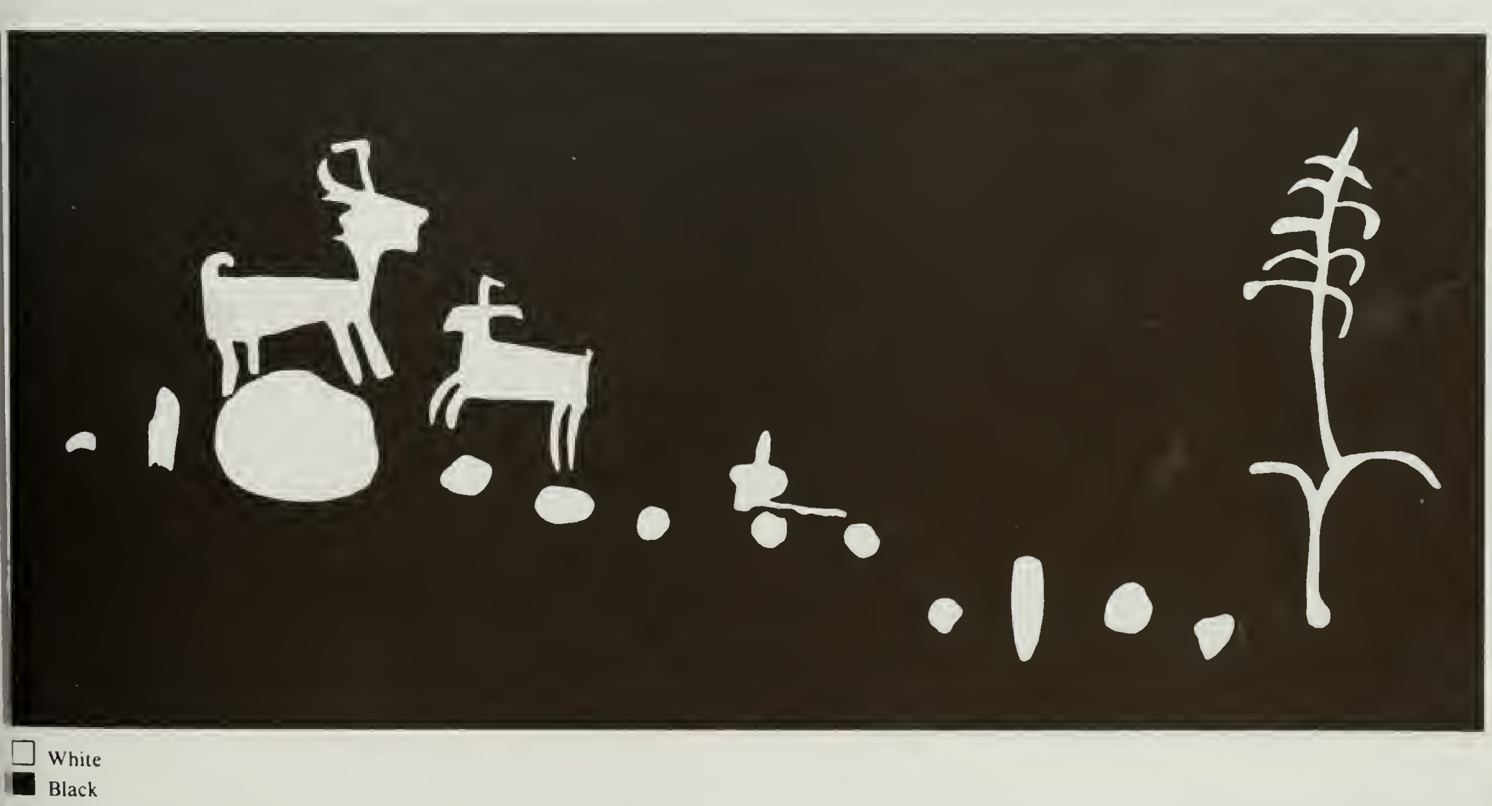
*See Table 5 for trait summaries, and Table 6 for color of each layer.



19. Plan of Kiva N, with reference points.



21. Kiva N, Layer 1, southwest wall.

south of RP 4 (fig. 22). Several of the dots from the top row peeled off with the removal of the plaster from Layer 2; however, there were probably 8 dots, one vertical line, and 8 more dots. The bottom row had 6 dots (at least one of which was enclosed in an incomplete, left-facing, bracket-shaped element), 10 dots, a vertical line, 5 dots, a vertical line, and one dot. The ninth dot, from left to right, had two vertical protrusions from its base, and the thirteenth had a single protrusion pointing upward.

The isolated motifs were immediately above the bottom row. There was an inverted "V" or "U" over the twelfth dot and an oval dot with a short upward protrusion was over the fifteenth dot. Above the nineteenth dot were two smaller dots—the first with a bifurcated appendage at the top, and the second with two appendages from the top. Over the last two dots and vertical line was an unidentifiable form composed of narrow lines.

Higher on the wall, 3.0 to 3.5 feet, an isolated fragment of plaster was decorated with an unidentifiable design in a thick white and dark red paint, 0.22 of a foot high.

On the west section just north of RP 5 was a double row of white dots with a maximum height of 2.0 feet and an existing length of 1.2 feet. The top row had 12 dots, and the bottom 11. They were spaced 0.04 to 0.06 of a foot apart, and as did all the dots in Layer 3, they averaged 0.04 to 0.05 of a foot in diameter.

Layer 4

A light-gray, soot-covered layer of ash plaster (Layer 4) was on all but the northeast and east walls. The plaster terminated near RP 9 and was begun again in the vicinity of RP 1; here, however, the actual termination point could not be located.

Decorations were on the west wall and consisted of a row of white gypsum dots, 1.2 feet long and 2.1 feet above the floor. The average diameter and spacing was 0.04 of a foot.

Layer 5

Layer 5, a white ash plaster 2.1 feet high, was found only on the western half of the kiva. The plaster began 0.03 of a foot west of RP 3 and ended 0.6 of a foot west of RP 8. The western section was decorated with a faint, red, diagonal line, 0.04 by 0.19 of a foot, with its lower end toward the south. A faint, narrow 0.02-foot zigzag line was 1.8 feet above the floor at RP 7 on the northwest section.

Layer 6

Layer 6 consisted of a lightly sooted, brown, adobe plaster decorated with bands that had local variations in color and design. They encircled the kiva, except between RP 9 and an undetermined point on the east or southeast wall. Between RP 9 and the ventilator was a series of incomplete and unidentified forms (fig. 23, see fiche A3). Yellow, red, black, brown, and then white was the usual order of color application. Orange was produced by putting red on yellow.

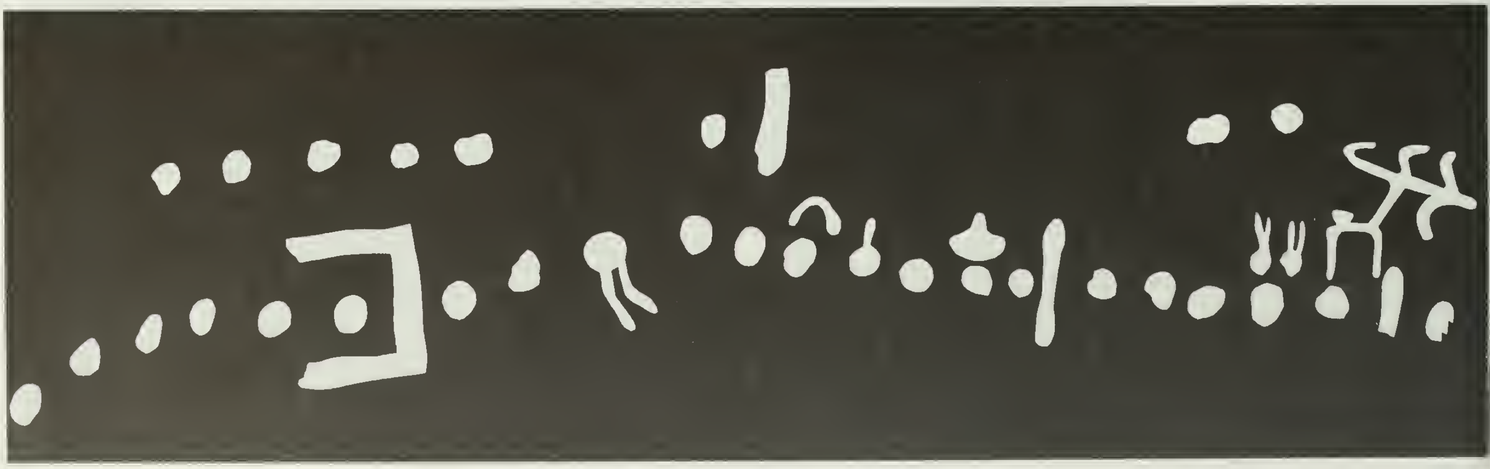
The existing field of design was limited to an area between 1.03 and 3.8 feet above the floor—in fact, at no point on Layer 6 did the plaster reach the floor. The top of the red band was between 2.0 and 2.5 feet high, with the usual pattern consisting of a red band on the top, a yellow band in the middle, and an adobe band on the bottom; below this the plaster was painted black (figs. 24-27, see fiche A4 through A7). The end of the band at RP 9 was squared (fig. 28). The maximum width of the bands was 0.4 of a foot.

On the northwest and north walls there were decorations above the bands. At RP 7 there were white dots and vertical lines in a 6/3/2/5 pattern. Over the first dot was part of what appeared to be an isolated, inverted "U"; the plaster was broken at this point, however, and the row was incomplete. To the right was a black triangle, outlined with red, yellow, and brown, with a black interior (fig. 24, see fiche A4). The apex of the triangle was missing. The black paint in the oblique angle formed by the lower right corner was much thicker than elsewhere.

Continuing eastward and still above the bands were several unidentified forms in red, yellow, and black. Little can be said of them, however, since their upper portions were missing and the paint on most of these forms was so faint that no distinct edges could be seen. The figures on the northeast and east walls (fig. 23, see fiche A3) east of the bands were also incomplete.

Only one small patch of plaster, beginning at RP 2, remained on the south wall. Variations consisted of black dots on the red, yellow, and adobe bands (fig. 25, see fiche A5).

On the southwest section (fig. 26, see fiche A6), west of RP 3, a faint yellow dot and two unidentified and incomplete forms (one red and yellow, and one white) could be seen above the bands on the adobe plaster. A third incomplete figure, standing above the red band, was a shield figure. A narrow white band, which outlined this figure, ran between the adobe plaster and the red band. Ten white dots were on the border between the red


☐ White
■ Brown

22. Kiva N, Layer 3, southwest wall.

and yellow bands. Here, however, what was usually a brown band was white, and below this was a very thick white line. Below the bands on the black paint was a narrow wavy line and a small triangle in white.

Only three adjacent small areas were salvaged on the west section (fig. 27, see fiche A7), just south of RP 5. On the adobe background above the bands, two black areas with right angle corners were incomplete. One was attached to the red band by two parallel, vertical, black lines.

Layer 6 was backed with a low, gray ash plaster. This patched holes in the lower levels on the south and west walls. On the north it covered the birds of Layer 7, except for part of the yellow-headed black bird. The plaster became thinner as it rose, with the height above the floor varying between 2.5 feet over the birds to 2.0 feet between RP 9 and 10, and rising again at RP 10; no height was recorded for the other walls.

Layer 7

Only the north side of the kiva was decorated on Layer 7, and dominating this (between 1.68 and 1.94 feet above the floor) were three birds facing west (fig. 28, see fiche A8). The first bird, from left to right, at RP 7 had a yellow head, brown beak, three white bars on the wing, and a black body and legs. In front of him were two joined horizontal circles outlined in black. Pointing down from them was a black arrow with bent shaft. Paralleling the upper portion of the shaft was an incomplete, thin, black line, and at right angles to the lower section was a horizontal black line with an upturned end. Protruding from behind the bird's chest was a red vertical bar with two transverse bars, topped with an inverted triangle. Above the bird's back was an incomplete flat bottomed area of thick white paint.

Farther east was a legless black bird with one outstretched wing and four long, narrow, tail feathers, each having one yellow dot and one red dot. Plaster spalling had removed the head of the bird.

Beginning at RP 8 was the most unusual bird. The first form in this group was a vertical black line with a rounded top and bifurcated base. On the lower half of this was a dot and to the right was another. The bird itself had a yellow oval head, black body and legs, and an outstretched wing. Facing and slightly overlapping the front of the bird were two concentric, bracket-shaped elements; in the resulting enclosure was a dot that overlapped onto the neck. Issuing from behind the junction of the back of the neck and wing was part of another dot, and east of the wing was another. Beyond this were two small unidentified areas of black paint.

The dots and brackets were gray. These and the black lines had apparently been applied with a dry-brush technique, which gave them an irregular paint surface, while the birds were solidly painted.

At RP 9 was a row of thick white dots and a vertical line. Because the edge of the plaster broke into the decorated area, no definite pattern was discernible (1/4/2/3). Another row of dots could be seen at RP 10—a red, a black, and seven white— which was followed by a long sloping area of thin, black paint. Below this was a red dot and two adjacent oblique lines, one gray and one yelow. The white dots at RP 9 and 10 varied between 0.04 and 0.06 of a foot in diameter. Farther right was a thick black band that was probably incomplete. Pendant from this was a narrow black line and a yellow rectangle. To the right were two faint red areas.

The background plaster on this layer varied in color. On the northwest wall it was a grayish off-white that thinned and stopped at RP 8. Here, a sandy pale-brown plaster, which was definitely the same layer, overlapped and continued eastward to 1.35 feet west of RP 9, where it overlapped onto the gray plaster again. The brown began once more near RP 10 and continued at least to the ventilator. This brown plaster was also on the southern half and on the west section, where it overlapped onto the gray. At no place did the gray plaster continue under the brown for more than 0.3 of a foot. The dots at RP 10 were on both the gray and brown backgrounds.

It is possible, and probable,that both colored mixes of plaster were applied at approximately the same time, since there was no accumulation of grime between the overlapping sections of gray-white and brown plaster. But why, we wondered, was the gray-white plaster only on the northwest and northeast sections? It is doubtful that the areas left uncovered after the gray-white plaster had been applied was an attempt to leave earlier decorations exposed. Only the dots and vertical lines of Layer 8 on the southwest section would have been seen, although it should be noted that this panel did have indications of redecoration (see Layer 8 description).

The maximum wall plaster height was 3.74 feet between RP 9 and 10, but averaged 2.7 feet elsewhere.

Layer 8

Layer 8 was a pale-brown to light-gray adobe with a thin coating of soot or grime on all sections. The southwest wall 1.4 feet west of RP 3 and approximately 1.6 feet above the floor was decorated with multiple dots as well as vertical lines, the largest of which was 0.2 by 0.05 of a foot.

There were three rows of dots in a thick white paint. The top row consisted of five dots, and probably more originally, with a hook-shaped element at each end; the first element almost formed a right angle, and the other was incomplete. The middle row had 12 dots, while the bottom row was made up of 6 dots, a vertical line, 5 dots, a vertical line, and 9 dots.

Between the middle and bottom rows were seven vertical rows of extremely faint dots, with five to nine dots in each. Two of the dots were overlaid by dots of the middle row. These are definitely on the same layer, probably indicating a redecoration of the layer.

On the isolated fragment of plaster that came from higher on the wall were yellow decorations. The main figure consisted of two yellow connected rings with approximate center diameters of 0.95 of a foot. There were also the remains of three scallops.

Layer 9

Layer 9, an off-white to light-gray plaster, varied in thickness on different sections of the wall and was covered with a thin layer of grime.

On the south wall, 1.7 feet above the floor, were the remains of three faint red dots, which measured 0.06 of a foot in diameter and were 0.12 of a foot apart. The southwest section was decorated between 3.0 and 3.5 feet above the floor. Only two small and incomplete areas of a thick black paint remained. Two layers of plaster, Layers 9 and 12, fell off the west wall.

Layer 10

A fine, hard-grained, undecorated white plaster, Layer 10 was located only on the northeast and east sections, between RP

9 and the ventilator shaft. At RP 9 the plaster rose vertically; the other terminal point, however, was not located. The plaster was on a sandy, light-brown, adobe backing that covered the same area.

Layer 11

Layer 11 existed only on the northeast and east wall between RP 9 and 11. The northern termination point was identical to that of Layer 10, but the southern point could not be located.

Decorations consisted of a mask (fig. 30A, see fiche A9) with a round face the color of the adobe plaster—a very dark gray-brown—outlined in black. It had round black eyes and a narrow black bar on the chin. On the left cheek was a single yellow dot, and on the right cheek, a red one. The mouth consisted of a black bar with three dots, turquoise, red, and dark gray-brown. Below the eyes were short black bars connected by a narrow line that dropped between the mouth and chin bar in a "U" shape. The headdress was peaked with an elaborate arrangement of horizontal elements.

One narrow section of yellow angled down and flared out from the mask—the only indication that this figure might have had a body. The bottom of the mask was 3.1 feet above the floor, which allowed space for at least part of a body. Most of the area below the mask was obliterated by the basal patch. The face and headdress measured 0.75 by 1.44 feet. To the right of the mask was an incomplete, diagonal, red line. One small area of red to the left might be the remains of an ear pendant.

Several other unidentified red, black, and yellow forms were further south. The red and yellow lines below the black figure had been painted over black paint.

Layer 11 had a burnt appearance; the darkness of the plaster was unusual, the plaster had more cracks than normal, and the red from the headdress peak was described in the original notes as "burnt red." However, Layer 16 on the north wall and Layer 12 on the south, both of which would have been exposed at the same time, showed no signs of burning.

Layer 12

Layer 12 was a coarse, light-brown adobe on the southeast, south, and southwest sections. The only decorations (fig. 30, see fiche A10) were just west of RP 2 and 1.58 feet above the floor. The main figure was a red-headed bird facing west; its eye, throat patch, and body were black, and it had vertical red and yellow lines in front of the tail, and red tail feathers.

Above and below the bird were faint yellow and red areas (possibly part of a spread wing), while above and in front was a row of ten small white dots, measuring 0.05 to 0.06 of a foot in diameter. The basal patch rose at least 1.8 feet above the floor.

Layer 13

An off-white plaster, Layer 13 was found on the southern half and the west sections of the kiva. Just west of RP 2 was a double row of dots and vertical lines, with a 2/18 pattern above the 6/4/8 pattern (fig. 31). The design, which was located 1.8 feet above the floor, was originally in white paint, but most of it came off the wall with the removal of the preceding coat.

A large white circle 0.52 of a foot in diameter had been done in a thick white paint that overlaid the western end of the dots. Through the middle of this and between the rows of dots was a horizontal bar with one upturned end; in the upper right hand corner was a smaller circle. Both bar and the smaller circle, which were of a thin white paint, were apparently applied with a dry-brush technique. Possibly this indicated a redecoration of the layer, or a damaged painting.

Layer 14

Layer 14 was a reddish brown adobe on the southwest section only, 1.85 feet west of RP 3 and 2.16 feet above the floor. It was decorated with a double row of thick white dots with a 4/1 pattern over 2/2 pattern. Below these were several small incomplete areas of red paint. The largest vertical line was 0.08 by 0.03 of a foot. All decorations were faint.

Layer 15

Layer 15 occurred on all southern and western sections. Only the southwest section (1.5 feet west of RP 3 and 1.8 feet above the floor), however, was decorated. Thick white paint was used on dots and vertical lines in a 5/2 pattern. The dots were 0.01 of a foot in diameter, and the vertical lines approximately 0.17 by 0.07 of a foot.

The grime-coated plaster, which varied in color from a pale brown to a light gray, had been applied to a thick pale-brown backing that contained the usual gypsum particles and charcoal.

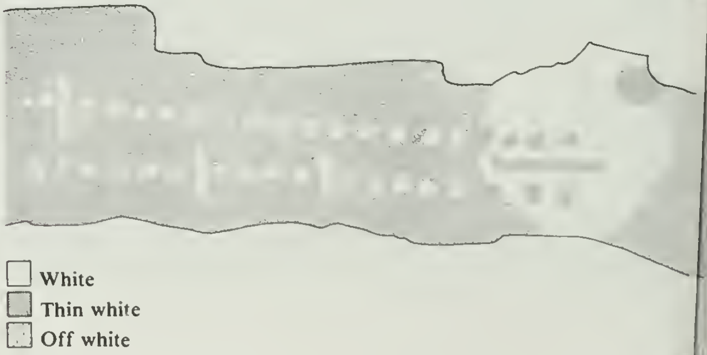
Layer 16

Layer 16 was the most brilliantly decorated layer in Kiva N. The plaster varied from a pale brown to a light gray and encircled the kiva. It was dominated by multi-colored bands approximately 2.0 feet above the floor and between 0.3 and 0.5 of a foot wide. There were no bands between RP 10 and an undetermined point on the east or southeast wall, nor on the isolated western section. To the east of the bands on the northeast section was one small yellow square.

The bands, from top to bottom, consisted of a narrow white line, red, yellow, and brown bands, and another narrow white line. As on Layer 6 the bands had local variations. The thick white paint on the two white lines came off the wall in many areas leaving only faint traces as an indication of their continuance. Red yellow, and then white paint was the usual order of application.

On the northeast wall (fig. 32, right; see fiche A11) the red and yellow bands jogged near their squared ends. The top white line was also squared, but indented. Above the bands was an incomplete and intermittent black band that extended farther eas The lower white line faded, as did the adobe band, which was a slightly darker brown than the background plaster.

On the adobe band just east of RP 9 and directly above a anthropomorphic figure was a roughly circular area of white speck Another similar but smaller area was 2.64 feet west. One white d was on the yellow band near its termination point.



31. Kiva N, Layer 13, southeast wall.

The top black band and the adobe plaster above it were decorated with motifs that once rested on the white line, but only the bases of these remained. The decorations included white, red, and yellow paint. Two similar sets of red figures were adjacent triangular elements with parallel lines coming into them obliquely from the west.

The plaster below the bands was brown, with two large irregular areas of black paint, one unidentified red, yellow, and brown design, and the lower portion of the anthropomorphic figure at RP 9. This figure had a red kilt with the waist and sides outlined in black, a thicker black waist band, a yellow sash, and white legs that rested on a black pedestal (fig. 32, see fiche A11). All that remained of the upper body were two small black areas that would have outlined the torso and one where an arm should have been.

Two isolated patches of plaster remained on the south wall, one just east of RP 2, and the other 1.5 feet west. The first (fig. 33, see fiche A12) had traces of the white line above the red and yellow bands. Below the yellow band was the brown plaster. Only one small area of contact remained between this and the black-painted plaster lower on the wall. Numerous small elements served as a divider between the color areas. The first element was a vertical sinuous black line with small protrusions toward the west and with its upper end missing. A red oblique rectangular element was attached to it by one corner. Connected to this by one corner was a narrow incomplete horizontal black line with a squared end.

Beside the sinuous line and roughly paralleling it was a straight black line with rounded ends. To the right and near its top was a vertical tapering line with a rounded top and an incomplete base. Below this was a tri-colored square—yellow, red, and black with a short, faint, yellow line hanging from the left side. Next was a slightly curved, vertical black line.

The two remaining black figures were also incomplete. Both had a central shaft with lateral down-curved barbs. One was on a yellow background. Below these was a nearly vertical red line with both ends missing.

The band pattern on the second patch on the south wall was basically the same (fig. 34, see fiche A13), but here the top line was a thick gray. The junction between the red and yellow bands had two small vertical-sided dips, while seven white dots bordered the yellow and brown bands. The bottom line was the usual white.

Painted on the black area below the bands were the wide vertical bands, one of yellow and one of red. The red band was terraced on its western edge. The yellow band had a thick, yellow, conical element on it, faded at the bottom. Near the center of this element were two small red cones, one vertical and one horizontal. On this fragment the plaster of Layer 16 extended over the basal patch. The lower area could not be completely uncovered, but presumably it did cover the patch to the floor.

The southwest section, 1.2 feet west of RP 3, had the top white line and red and yellow bands (fig. 35, see fiche A14). A narrow, thick black line separated the bands from the black paint below. On the black area was an inverted white "V" with a red interior.

Two small pieces of plaster represented the west section (fig. 36, see fiche B1). There were no remaining bands in this case, but since the top of the plaster was 2.4 feet and the bottom 1.7 feet above the floor, it is possible that there once were bands above or below the existing plaster. All that remained of the decorations was an incomplete yellow panel framed by two white vertical lines on the brown background. A white horizontal line 0.1 of a foot wide with one black end was connected to the southern framing line and divided the yellow area. Above the horizontal line in the southern corner was a small white square. All decorations below the line—four spots and an unidentifiable figure—were also white. All white and black paint had been applied over the yellow.

Layer 17

Layer 17, a gray to brown plaster, was found on all but the southeast and southern sections (because of the poor condition of these areas, it was not always possible to determine whether this plaster was ever present). The only decoration (fig. 37, see fiche B2) was on the east wall, 1.5 feet north of the ventilator and 1.7 feet above the floor. The decoration consisted of one incomplete figure, faded away at the top and bottom.

The figure was a weak red with parallel sides and a dark-red flared straight bottom 1.24 feet wide. Four narrow lines (from top to bottom, dark red, orange, yellow with three small turquoise dots, and weak red) crossed the body where it flared, separating the two red areas. Above the dividing lines the body had an incomplete narrow zigzag line, and at its lowest point another zigzag formed a diamond.

Below the bands were three large circles. The left circle had an outside ring of an unknown color, then a thin black line, then a yellow ring, a dark red ring, and a yellow center. The middle circle consisted of a narrow yellow ring with a large weak-red interior. The circle on the right had an outside yellow ring, then a dark-red ring, and a black interior.

Beneath the main part of this design, at the lower left corner, was a faint weak-red element with a serrated base and four yellow spots. The other corner had traces of yellow paint. Near the middle was an incomplete weak-red band that paralleled the bottom; on this band there was one heavier area of the same weak-red, as well as black.

The southwest wall had a "spotty" light-brown backing, which filled holes in Layer 18.

Layer 18

Layer 18 was a hard, fine-grained, white plaster with traces of a light-gray backing on the north, east, and south walls. It was present around the entire circumference of the kiva—in fact, it served as one of the guides for matching layers from different sections. One interesting feature was that Layer 18 was only 2.4 to 2.8 feet high on all undecorated walls. Just north of RP 10, and forming the background for the decoration on the northeast and east walls, the plaster rose sharply to at least 4.4 feet—the only point where it extended to such a height; in other places the plaster was broken, and over the ventilator and southward, only fragments were left. Originally, somewhere in the vicinity of RP 1, the plaster would have dropped again.

All that remained of the decoration (fig. 38, see fiche B3) was confined to a narrow band with a maximum width of 2.2 feet that was located between 1.5 and 2.0 feet above the floor. The plaster above this was either undecorated or missing. Below, the basal patch had destroyed everything. Over the ventilator, patches of an unidentifiable design remained, and between the ventilator and RP 1 occasional fragments or orange and yellow paint could be seen.

The largest motif was pink (Munsell: "moderate red"). The left side was almost complete, but the right was missing. Although most of the top edge was also missing, it appeared to have had a flat top. What was possibly the base was irregularly and deeply scalloped. It was decorated with three irregular and generally horizontal rows of yellow, orange, purple-white, and dark-gray diamonds and laurel leaf shapes outlined in white. Here, as on all of Layer 18, the white patterns and outlines were formed by the absence of any paint, which allowed the background plaster to show through. In the middle row there was a small orange dot between one leaf and a diamond, followed by another orange dot and another diamond.

The existence of another pink area partially outlined in black at the upper left corner, along with black paint above the center, indicated that the decorations probably once continued upward. Both were separated from the main figure by a white outline.

A quiver filled with arrows emerged from behind the upper left portion of the pink figure. The quiver consisted of the hind quarters, spread legs, and tail of an animal all in yellow. At the end of the long tail was a black tip, separated by a white line.

Apart from the legs and tail, but pendant from them, were tassels. Those below the legs had dark-red triangular heads; the tails or fringe were also dark-red, but had colored centers and rounded bases. The centers were elongated, with flat tops and rounded bottoms. The left tassel, which was a moderate red color partially outlined in black, was topped with a yellow trapezoid, while the right one was black with the same yellow trapezoid. At the lower left edge of the right tassel was a trace of yellow paint that was separate from the fringe. The lower portion of the tail's tassel was missing. The triangular head and left half of the fringe that was visible, however, was reddish orange, and the right half of the fringe was black.

The quiver was filled with an intricate mass of fletched or painted multi-colored arrows whose nock ends were missing. At least 11 arrows could be seen, although there were possibly more. (Only when a line running from the quiver toward the nock end was unbroken was it considered to mark the edge of an arrow.) Markings or fletching varied from one to six colors per arrow. Most had a short colored area near the quiver, with the remaining length single-colored or patterned. The colors were several shades of red, turquoise, black, and white.

To the right of the largest motif and over the ventilator were the remains of another unidentified element.

Layer 19

An undecorated dirty white plaster, Layer 19 did not stand more than 2.5 feet above the floor. On the southwest and west sections of the wall, no actual height was given other than a notation that it was "low."

Layer 19 was backed by a brown adobe that was approximately the same height as the white plaster. On the east and west walls this backing plaster patched holes in Layer 20. On the east wall it was further possible to tell that these patches extended through Layers 20, 21, and 22, indicating that this wall had been in very poor repair prior to the reconditioning.

Layer 20

Layer 20, a soiled or sooted undecorated layer, varied in color from white to gray; it was unevenly applied.

Layer 21

A white to light-gray plaster with a heavy coating of grime made up Layer 21. The southwest section had a horizontal black band or line whose top was approximately 0.2 of a foot above the basal patch; its bottom was missing. The patch was 1.0 to 1.5 feet above the floor.

On the northeast and east wall, 1.4 feet south of RP 10 and 1.9 feet above the floor, was a fragmentary unidentifiable figure 0.43 of a foot tall (fig. 39, see fiche B4). The figure was of an unusually powdery brownish yellow paint that often faded, leaving no distinct edge. The left side and the bottom were outlined in a thicker paint of the same color, while the top had vertical bars composed of alternating sections of dark red and yellow. The red paint had been applied over the yellow. An isolated patch of yellow paint could be seen at RP 10, and there were several more immediately south of the main figure.

Layer 22

Layer 22—a white and gray plaster with a coating of dirt or soot—was noted on all sections. On the east wall, 2 feet above the floor, were six faint traces of a powdery yellow paint, which were 0.2 of a foot apart and had an approximate diameter of 0.01 of a foot; possibly they were the remains of dots.

Layer 23

An undecorated coarse-grained white to light-gray plaster containing small flakes of gypsum, Layer 23 was found on all sections. The plaster height was 2.1 to 2.4 feet on the north, east, and southwest walls, but was not recorded on the southeast, south and west sections.

Layer 24

Layer 24 consisted of a fine-grained, hard, polished, white plaster on a gray to olive backing. The only decoration occurred on the east wall between RP 10 and 11, just north of the ventilator (fig. 40, see fiche B5).

On a small piece of plaster 2.1 feet above the floor was an arc with the top and possibly the bottom missing. At its widest point it was 2.12 feet across. On the right side of the arc was one small patch of white paint on the gray. The arc itself was outlined by a narrow gray line, inside of which were the remains of more concentric arcs; they were, from largest to smallest, yellow, red, gray, and another red. In the middle of the arc a red circle was outlined with gray, and pointing up from it were four narrow vertical lines: red and yellow between two gray lines. Below it were fragments of a horizontal gray line above red paint.

The arc had been redecorated with a coat of red paint that filled the entire area inside the gray arc. One faint, short, yellow, vertical band, 0.08 of a foot wide and halfway between the left side and the center, was all that remained of an decoration on this arc. This redecoration is not illustrated.

At this point the southeast and south walls had deteriorated to such an extent that they will not figure into any further layer descriptions. All of the work on these areas was done on isolated fragments of plaster, and as the work progressed these became smaller and smaller. Layer 24 was the last layer uncovered that could be related to the other layers with any degree of confidence.

Below Layer 24, two, and probably three, layers were lost. The lower of these was a "whitish color" that would probably correspond to Layer 27 on the other walls. Layer 28 was the last layer of plaster on the south and southeast walls.

Layer 25

Layer 25 was a brown soot-covered adobe. Although traces of red paint were on the southwest, northwest, and north walls, no design was discernible. According to our notes the paint traces were 1.5 feet above the floor on the southwest section. On the east wall were the remains of a thin yellow paint, partially outlined in black, but here again, nothing further could be said.

On the east wall the basal patch was directly over Layer 25, which helped to obliterate the decoration.

Layer 26

Layer 26 consisted of an undecorated, fine-grained, hard, polished, white plaster that was covered with a deposit of grime.

Layer 27

Another hard, fine-grained, white plaster, Layer 27 was located 2.4 to 2.9 feet above the floor. The adobe kiva liner was exposed above the plaster, and both were covered with soot or dirt. On the north wall were a few brush-like striations that primarily occurred horizontally. On the northwest and north sections the top of the plaster was decorated with a narrow (0.14 of a foot) line of a thick white paint.

Layer 28

Layer 28 was a dirty or soot-covered, fine-grained, hard, polished, white plaster found on all sections. This had apparently been the first layer to circumvent the kiva. The original plaster height was 2.0 to 2.3 feet on the northwest, north, southwest, and western sections. Just north of RP 10 the plaster rose to a height of at least 4 feet and was probably higher.

The only decoration was at RP 9 on the north wall. Immediately below the top of the plaster was the left half of a black arc. The outside edge, and three narrow protrusions to the west, were a thicker and darker black paint than the remainder of the arc. To the left was an incomplete vertical black line with a rounded top 0.22 of a foot tall.

The last three layers (29, 30, and 31) were located on the northeast and east walls only. The adobe wall liner, which was exposed on the other sections, was heavily coated with grime.

Layer 29

Layer 29, a very thin, granular, gray slip, had been applied unevenly; it showed brush marks and adhered well to the decorated areas of Layer 30. The layer began at RP 10 and continued at least to RP 11.

Layer 30

Layer 30 was a low layer (2.7 feet high) of a fine-grained white plaster on a friable light-gray backing. The plaster began with a vertical edge 1.5 feet north of RP 10 and extended at least to RP 11. Nothing could be done with the wall above or south of the ventilator.

The unidentified multi-colored decorations were incomplete (fig. 41, see fiche B6). The top element was a red band 0.22 of a foot wide at the top of the layer and partially on Layer 31. On the band and the white plaster below it were vertical and horizontal lines and bands, along with an inverted, rectangular "U" in various shades of red, light gray, yellow, black, white, and light brown. The lower portions of the decorations were destroyed by a basal patch.

Layer 30 had been redecorated with a band of very dusky red that was approximately 1.26 feet wide. The band extended from the top of the layer and overlapped onto the basal patch, covering all decorations. The occurrence of this band on the basal patch and on the second layer in Kiva N indicates that the occupants must have been having trouble with the walls and plaster at a very early time.

Layer 31

Layer 31—the first one applied—was on the northeast and east wall between 1 foot north of RP 10 and the ventilator. It was impossible to tell how far south the layer went, but we did locate the northern vertical termination point. The plaster was a fine-grained, polished white, with a maximum height of 3.2 feet.

The only decoration was the top of a plain yellow band 2.2 feet high. There were no ends, and the power portion had been destroyed by the basal patch that was 1.5 feet high. This was a difficult decoration to uncover, since the yellow did not adhere well to the plaster.

Kiva K*

The only plaster remaining in Kiva K was on the walls of the original kiva built in A.D. 1473. This adobe-lined structure had burned and was then relined with masonry to form another smaller kiva (Hayes, 1980). Tests into and behind the walls of the later kiva revealed plaster on the original walls to approximately 1 foot above the floor.

Since it was not feasible to uncover these layers without removing the masonry wall of the last kiva, little information could be obtained. There were nine layers of plaster, and probably more. At least two were decorated with red paint on one, and red and white on another.

On a small fragment fallen from the north side was one layer decorated with a white motif, 0.14 by 0.1 feet, on a brown background (fig. 42a). The last layer had a thick white dot and several faint white lines on a dark-brown plaster.

Kiva L*

Kiva L was built during the 1400's, and little information could be obtained regarding the murals there. The field notes record that the "plaster had fallen leaving from 1.0 foot to 1.6 feet standing above the floor too badly broken to save." However, a few small fragments were brought into the laboratory for later examination.

On one piece that was examined in the field, the adobe liner, according to the notes, was covered with "10 layers [of a] light sandy brown plaster [each] painted with thin white gypsum wash." The first and last layers of gypsum were decorated with bright yellow ochre and with red paint, respectively. The notes also state that "each white layer was smoke-blackened."

Only one decoration was found intact. Located 1.1 feet above the floor over the ventilator tunnel (fig. 42b), it had scalloped white lines enclosing alternating red and black areas. Above this was a "dark orange" paint and below was black. Vertical white and red lines were on a "dark gray" background farther below. Possibly the black had faded into a gray, since the sketch showed no break between the two colors. No dimensions were recorded.

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*See Table 7 for trait summaries and Table 8 for color lists.

Upon examination of the plaster fragments that had been brought into the laboratory, 20 coats of alternating white and brown plaster were uncovered. At least five were decorated: two white layers had yellow paint, and one had red; two brown layers had yellow paint; and at least one brown plaster was decorated with yellow, red, black, and white.

Since the fragments of plaster tended to crumble when scraped, individual layer colors were not obtained. Only enough was uncovered to ascertain whether a layer existed, and, if possible, to tell if it was decorated. As usual, most layers were coated with a layer of dirt and soot.

Room 12*

Room 12, which was built in approximately A.D. 1545 (during the Late Phase), was used until the pueblo was abandoned in the 17th century. Although the plaster and murals occurred on the north, west, and east walls, the plaster remaining on the west wall was the most complete, being 5 feet of the original 9-plus feet. On this wall the plaster was missing from the southern end, and the upper left corner had been patched.

The plaster on the northeast corner was isolated and on both walls. According to the room notes, there was a minimum of 23 layers; at least four of these had rows of dots and vertical lines, one of which went around the corner. On the east wall, 0.8 of a foot south of the corner and 1.6 feet above the floor, was an intricate design with "white lines around black and on a red background" (fig. 43). This was superimposed by three layers with white dots separated by vertical lines. No further information was available on this area.

The north and west walls, adjoining their mutual corner, were badly damaged by roots. Because they were obviously decorated and could not be worked on in a vertical position, it was decided to remove them to the laboratory.

Layer 1

Portions of Layer 1—a brown adobe coated with soot—existed on both the north and west walls at the corner. On the west wall, 3.07 feet south of the corner, two fragments of plaster were decorated with dots and vertical lines, 2.0 feet above the floor. The decoration, done in a thick white paint, consisted of three rows of dots with two vertical lines. The complete vertical line was 0.22 by 0.04 of a foot. Because a gap existed between the decorated

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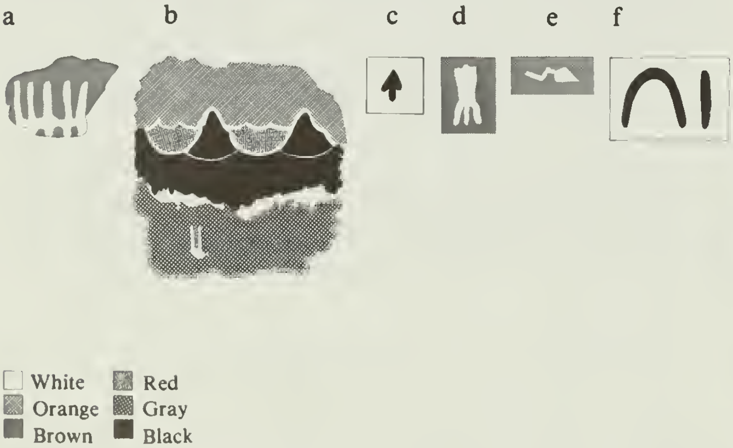
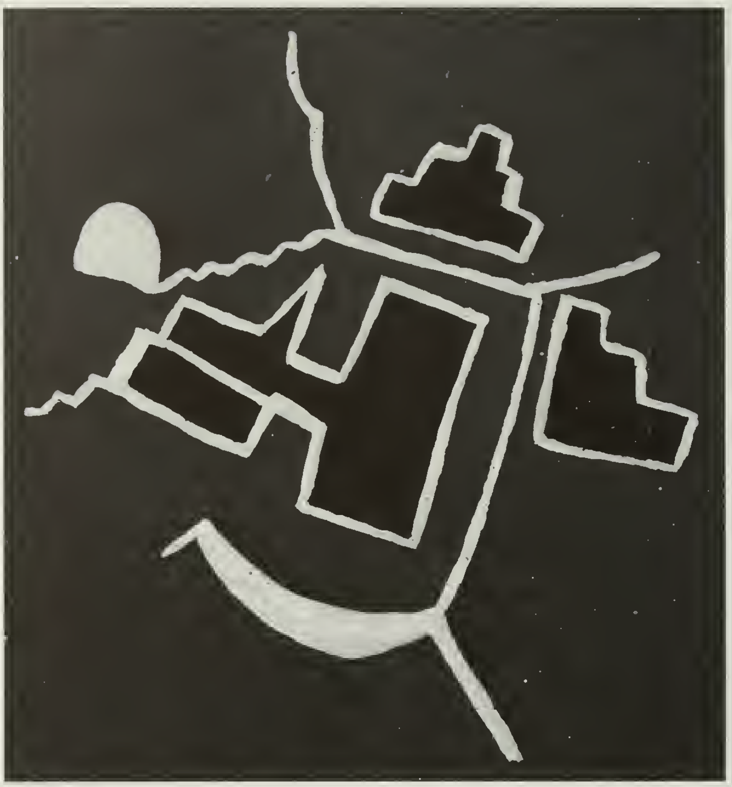
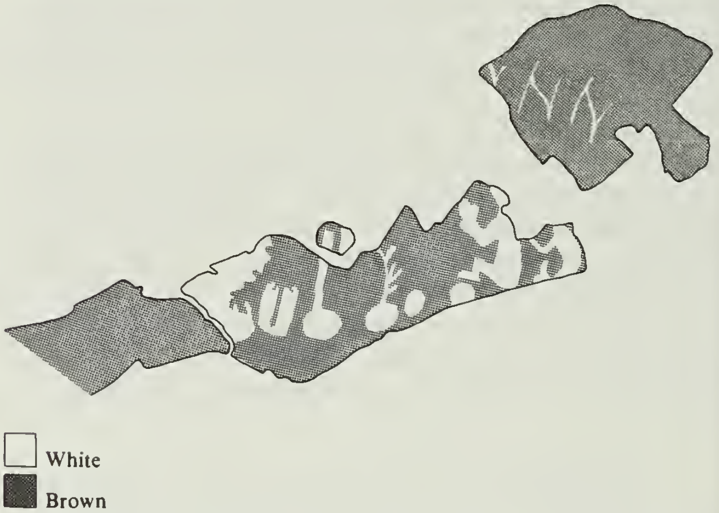
*See Table 9 for trait summaries and Table 10 for color list.



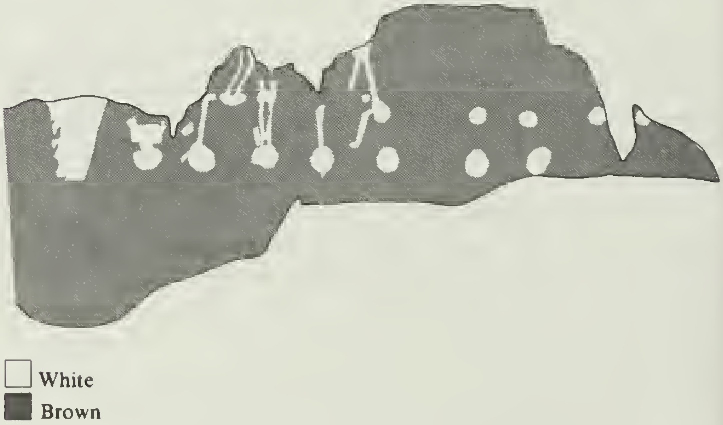
42. Decorations from various kivas and walls.



43. Room 12, east wall.



44. Room 12, Layer 3, north wall.



45. Room 12, Layer 6, west wall.

areas, a number of dots appeared to be missing, and it was impossible to speculate about the original pattern.

Layer 2

Layer 2 was a soot-covered, brown, adobe layer on the north and west walls. On one small segment of plaster on the west wall, 3.17 feet south of the corner and approximately 2.0 feet above the floor, there was a series of white forms; one was tipped with red, and between two others was a narrow black line. The length of the existing decoration was approximately 0.05 of a foot.

Layer 3

A small portion of Layer 3 was on the north wall; it extended around the corner onto the west. Here, only two of the numerous fragments were decorated. These, which were 2.82 feet south of the corner and 1.8 feet above the floor, were done in a thick white paint (fig. 44).

The lower decoration consisted of several unidentified forms–dots with "things" sprouting from them, and plain dots. To the right of the dots were what appeared to be two incomplete seated anthropomorphic figures, 0.26 of a foot tall, facing south. Above the figures were three fine-lined curvi-linear elements that resembled a capital N.

Layer 4

When Room 12 was excavated a large part of Layer 4 on the west wall was exposed revealing a "human figure several inches tall which was decorated with black, red and white feathers"; the wall was encased in plaster and brought into the laboratory, where it could be worked on in a horizontal position. The figure was cracked and held in place by masses of roots, and, unfortunately, with the removal of the tissue paper, the area disintegrated.

The plaster was a very thin brown adobe that must have been in poor condition, since Layer 3 patched holes in it. This was on backing of a reddish adobe.

Layer 5

Layer 5 was an undecorated, soot-covered, reddish adobe on the west wall. The plaster along the northwest corner deteriorated rapidly, and it was not possible to tell if the plaster continued onto the north wall. Further descriptions will refer to the west wall only unless specified.

Layer 6

The brown plaster on Layer 6 was extremely fine-grained and thin. It and the white designs on it were covered with a heavy coating of grime. All that remained of the decorated panel was an area 2.85 feet south of the corner and 2.0 feet above the floor. At the left was an incomplete form with one definite straight edge; this was followed by a double row of dots with various appendages, then plain dots (fig. 45). The largest dot was 0.06 of a foot in diameter.

Layer 7

Layer 7–a spottily blackened, fine-grained, gray plaster that adhered to Layer 6–was deeply striated, resembling the interior of a well-scored Chupadero Black-on-white jar. Possibly the plaster had been applied with a brush.

Layers 8 and 9

Layers 8 and 9 were in poor condition, and it was difficult to distinguish between them. Both were dirty brown adobe plaster, and on one was the remains of three white dots, 0.04 of a foot in diameter, approximatley 1.9 feet above the floor and 2.0 feet from the corner.

Layer 10

Layer 10 was another grime-coated brown plaster on a brown backing. Like Layer 7, it was very thin and scored.

Layer 11

A lightly scored, light-gray plaster made from ashes, Layer 11 was very hard and appeared to have been floated. It was on a brown backing. The plaster had been painted black, then decorated with white and black paint; it was coated with a layer of soot and dirt (fig. 46, see fiche B7). The designs were 1.2 feet above the floor and 1.25 feet south of the corner.

An incomplete row of white dots was the dominant theme. Modifications included one dot with tendrils attaching it to a larger dot above. The adjoining dot had been applied over narrow vertical black and white lines, which were also attached to the larger dot. Farther to the right, a dot with a dip in its top was above the row. At the end of the row one incomplete black area with one straight vertical side was below the row, and three fanned lines above. One of the fanned lines had a serrated top, one was incomplete, and the other had a curved top. The bottoms of all were missing.

Lower on the wall was a vertical black line, and farther to the right of this was a vertical white line framed by two narrower black lines. The white line was 0.17 of a foot high by 0.06 of a foot wide.

Layers 12 and 13

Layers 12 and 13 were undecorated, blackened, adobe layers, gray and brown respectively. Layer 13 had a brown backing, which patched holes in Layer 14.

Layer 14

Layer 14 was a grime-covered brown plaster with a 2.4-foot row of thick white dots and vertical lines in a 5/10/10/10/3 pattern. One dot appeared to have been deliberately removed, and the lower portion of another had been painted over. Only traces of the original dot were left. Above one line was a crescent. The decorations were 0.21 of a foot from the north corner and 1.8 feet above the floor.

Layer 15

Layer 15 revealed the most spectacular of the murals, with masked dancing figures and dots with vertical lines (fig. 47, see fiche B8). The anthropomorphs were realistic, animated, and in perspective. Incomplete designs to the left suggest that the dancers once continued there. Below the first anthropomorph there were the remains of several motifs, at least one of which resembled a feather. This was also indicative designs lower on the wall. The dancers were 1.06 feet above the floor, with the largest 1.48 feet tall.

The top row of dots had a 16/3/3 pattern, and the bottom was 13/3/3. Because some plaster was missing, it was impossible to tell if the top row of dots continued to the southwest corner; the bottom row, however, stopped at the dancers. At the time of the exposure of Layer 15, we suspected that there should have been one more dot on each row at the north end, but the rim of the jacket prevented any definite conclusions.

There was a careless use of paint in the mural, resulting in drips and spatters that made it difficult to distinguish between deliberately depicted lines and "mistakes." For simplicity, those drips which appeared to be just that were deleted from the reproduction. Where in doubt, we left them in. Furthermore, because of spattered paint and the lack of detail, it was difficult to know where the different personages stopped or began.

There appeared to be eight figures, or parts of eight, which are in a rank grasping each other's arms or hands—or, more likely, there are two staggered ranks.

The first figure on the left was incomplete, with a featureless white face, a yellow neck, and a red torso; he was without legs. The torso ended at a horizontal white line that was probably a belt. Tucked into the belt was a vertical white object, and parallel to this (but not attached to the belt) was another. A white object hung along one side of the face, possibly representing hair. White bands encircled the figure's biceps and raised forearm, and a black object with a white tip hung from the armband. On his right shoulder and at his throat were white marks.

Beside the first figure's head was a featureless yellow face with black hair and the upper portion of a red body. The red torso of both figures, however, appeared to blend together, and where they joined, there were six white spots. Possibly the yellow patch by the third figure's foot was part of the second figure and the yellow stripe on the third figure's arm was the left arm of the second. The second person may have been intended to be a second or back row.

The next individual had a red body, a black featureless face, a red and white "stocking cap," and black and white moccasins. There was a white spot on the right side of his face, one at his throat, and one near his left brow; below the latter spot a white right-angle element with a red tip was situated beside his face. White lines and spots were on the legs, waist, and the left arm, and a black and white object protruded from behind the figure's waist. Both arms were partially raised. At the wrist and shoulder of his right arm, which was bi-colored, were white and red elements.

In his left hand the figure was holding a large white object with a pointed red tip. It is possible that both the second and third individuals were holding the white and red objects—the red-tipped feather behind number 3's head (on his left side) may belong in number 2's left hand, and the elements beside number 2 may belong in number 3's right hand.

Support of this interpretation lies in the red-tipped feather behind the fourth figure, which appears to be in number 3's left hand. This is firmly borne out in the red feather in number 5's hand. If all this is correct, then the white object at number 1's right shoulder and the white and red element at number 3's right shoulder are probably held in the right hands of the figures to their left. The sixth individual is definitely carrying a white plume in his right hand. The white blotch on the upper arm of number 3, then, may be number 4's plume, and the white and red element to the right of number 5's face is *his* right-hand plume, but his arm is extended to the viewer rather than to the side. This interpretation not only supports the theory of two ranks of dancers, but also illustrates the remarkable use of perspective.

The black dancer was in the back row, and only his left arm was visible. He was featureless, with one red feather on his head and numerous white spots on his body. There were two spots on his face, and one on his arm. On his torso the spots were in four vertical rows, with three rows on his right leg. The left leg was solid black.

The fifth figure was a bi-colored (yellow and red) black-faced individual with two red eyes. He wore a white skull cap with three white black-tipped feathers coming from a white and red object above the cap. On his chest was a round turquoise and white object. His body was divided horizontally by an area of missing paint. Above this were narrow white and red lines, and below a white line. He had what appeared to be yellow genitals. The yellow leg was topped with a section of a thinner and lighter yellow paint, and down the center was a turquoise strip and miscellaneous white and black patches. The red leg had one white spot and ended in a white and black moccasin. Several white patches and spots were on the figure's torso and arms. He appeared to be holding white and red objects in raised hands. Between the black and bi-colored dancers were large red and white objects that could belong to either individual.

The white dancer had black eyes and bobbed hair, raised arms, a red knee, and a red marking on his foot. His body was divided vertically by an uncolored long rectangular line. One yellow spot was on his neck. He had yellow, red, black and white, and black hangings from his right arm, and a yellow wrist band on his left. In his right hand was a white, black-tipped object, and in his left was a small white dot. Emerging from behind his back was a black element with white protrusions.

The seventh individual had red bobbed hair, a black rectangular face, a red torso, raised arms, a black kilt, and white legs. He wore a headdress consisting of a feather with four red lines extending upward. Also above his head was a white shaft with three feathers attached—one to the top and two on one side. (It is quite possible that this feathered staff would have been in the right hand of the nearly obliterated dancer, number 8.) On number 7's right shoulder was a black rectangular object. His left arm had a yellow band and a white black-tipped arm hanging. A white and yellow object was tucked into his belt. There was one red and yellow tassel on the lower right edge of the kilt.

Continuing northward there were several scattered areas of black, yellow, and white paint, which were all that remained of number 8. Additional unidentified patches of paint were associated with the dancers. Above number 4 and behind the headdress of number 7 were several areas of thin white paint, which had been produced a dry-brush technique.

A thicker white paint was on the dots and vertical lines than was on the dancers. The two shades of red and yellow were produced by using different thicknesses of paint. The yellows were applied first, then the reds, followed by either turquoise, white, or gray, and last, black.

The background plaster, which was a hard fine-grained gray under the anthropomorphs, became a more friable brown at the north end of the wall. Everything was covered with a light layer of dirt or soot. Only the southern part of the wall had any backing—a pale gray.

Layer 16

Approximately 3.47 feet south of the north corner and approximately 2.10 feet above the floor of Room 12 was a black-stemmed arrow point or triangle on a hard white plaster (fig. 42c). The motif was approximately 0.06 by 0.04 of a foot.

Layer 17

Layer 17 was an undecorated, blackened, brown adobe that apparently was in poor condition while still in use. In many places Layer 15 was directly on Layer 17.

Layer 18

Layer 18 consisted of an extremely thin, undecorated, fine-grained, hard, white plaster on an equally thin brown backing. The backing began 1.7 feet south of the north corner and was approximately 1.5 feet high. This layer was difficult to uncover, since it adhered to Layer 17. A basal patch, extending to 1 foot above the floor, covered Layer 18.

Layer 19

Layer 19, a pale brown adobe, had an intermittent 0.03-foot-wide band of white "paint splatter" 1.9 feet above the floor. A thick black coat of soot or paint covered the wall and band, possibly as a deliberate obliteration of the decoration.

Layer 20

Layer 20 was simply an undecorated brown adobe.

Layer 21

Layer 21 was a grime-covered brown adobe that had been repaired with gray and brown plaster before the wall was decorated. A large portion of the patch at the upper left corner of the west wall was on this layer. Part of the patch, as well as an area 1.0 by 0.4 of a foot around it, had been replastered. The lower portion of the wall had also been repaired and replastered in several places.

The wall was then decorated with a 1.62-foot row of dots and vertical lines (fig. 48, see fiche B9) in a /9 or 10/10/10/12?/6/9/10/ pattern. One short vertical line was above the dots, and several appendages below. The first vertical line, from left to right, had a dot with a long fine-lined tail attached to its bottom. Above the tail was an isolated fine line. In the row of dots that followed, there was a motif which resembled a feather emerging from two dots. To the left of the first vertical line was an incomplete form. All the designs were in a thick white paint. The vertical lines were 1.9 feet above the floor.

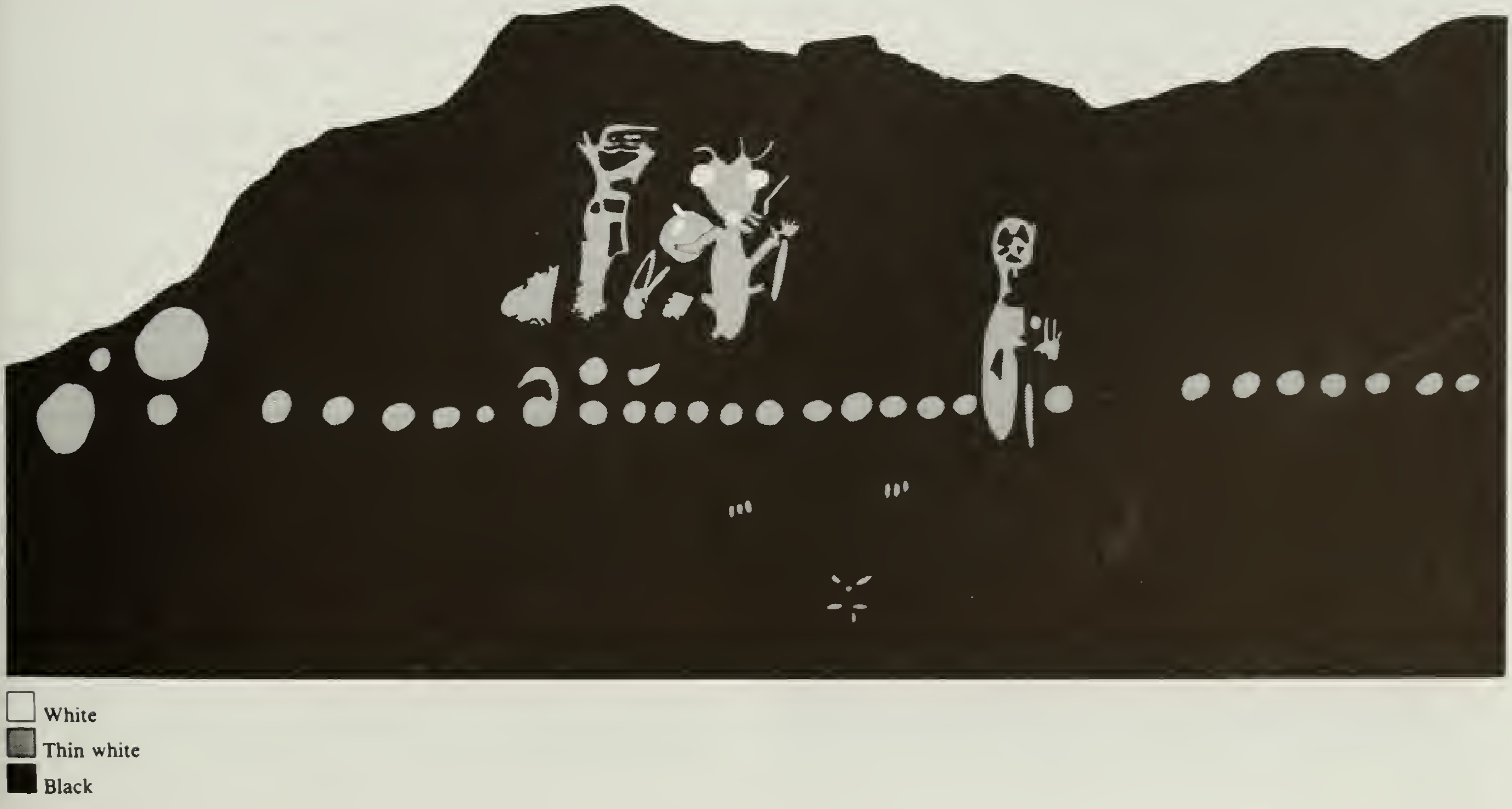
On the lower portion of the wall was a design that appeared to be on one of the replastered sections, but due to the poor condition of the plaster, there was a slight chance that this was actually on another layer. The design consisted of two incomplete and unidentified motifs in white; the first motif also had one small area of red paint.

Layer 22

Beginning with Layer 22—a blackened brown adobe with no decorations—there was plaster on the remaining 10 layers of the north wall as well as the west wall. Layers 1 through 4 had been evident only where the plaster turned the corner, but because the corner crumbled, it was not possible to tell if the succeeding layers were also on the north wall. Probably all or most of the layers, 5 through 21, were represented.

Layer 23

Apparently the brown plaster on the west wall was originally decorated with a row of small white dots and one vertical line. The north and west walls, however, were then exposed to soot and dirt or were painted black. Over the blackened surface new white decorations were painted on the west wall (fig. 49), and a double row of five dots was painted on the north wall.



49. Room 12, Layer 23, west wall.

The original row of dots was 1.5 feet above the floor. The new double row was 1.6 feet above the floor, approximately 0.15 of a foot apart, and 0.1 of a foot in diameter.

The new west wall decorations consisted of a row of dots that were roughly divided into thirds–first, by a dot with an upward curved extension, and second, by a distinctive figure beside a vertical line. One large dot was at the southern end of the row, and another, 0.18 of a foot in diameter, was above and slightly to its left.

Above the row were numerous unidentifiable elements. One was incorporated into the row. Through the use of varying thicknesses of paint, the central form gave the appearance of having eyes, mouth, hands, and antennae. Below the row were three groups of small clustered oval spots.

Layer 24

Layer 24 consisted of a grime-coated, fine-grained, dark-brown plaster with striations or brush marks on the north wall.

Layer 25

Layer 25 was a pale brown plaster covered with a light layer of soot or dirt. The west wall was decorated with a row of 10 dots, a vertical line, and 10 more dots (fig. 50). At the left end of the row, in thick white paint, was a rectilinear enclosure with equal sides and an opening to the north (right); it had a dot in its center and was framed by terraces on all but the open side. The dots were 2.05 feet above the floor and 1.6 feet south of the northwest corner; the decorations covered an area 1.96 feet long.

Layer 26

Layer 26 was a dirty brown adobe. The west wall was striated and varied in thickness. On the wall was a row of white dots that had been redecorated by painting a thin, white, vertical line over one dot and by using the same thin white paint to cover two dots and a short line near the upper portion of the wall (fig. 51, see fiche B10). Below and to the left of the row were various combinations of white and black elements and black lines. The designs, which began 1.97 feet south of the northwest corner, were 1.24 feet above the floor and 1.5 feet long.

The north wall had an incomplete row of dots and vertical lines on two isolated fragments of plaster at the northwest corner. This was 1.5 feet above the floor and 2.16 feet long. The white paint on both walls had a slight amount of yellow in it. The north wall was almost entirely exposed when it was jacketed, and part of this could have been discoloration from the yellow tissue paper.

Layers 27 and 28

Layers 27 and 28, which were undecorated, had a hard, fine-grained, polished white and a brown plaster, respectively. Both were coated with grime.

Layer 29

A blackened brown plaster, Layer 29 was decorated on the north wall only. The designs were on a small isolated fragment of plaster at the northwest corner, approximately 1 foot above the floor. The design consisted of pale brown and black triangles. The same brown outlined the upper right corner of the adjacent white band. To the right was a black circle outlined in red, 0.18 of a foot in diameter. The patch on the upper left corner of the west wall rested on Layer 29.

Layer 30

Layer 30 was another undecorated, soot-coated, brown adobe.

Layer 31

A dirty brown adobe decorated with a thick white motif on the west wall, Layer 31 was 1.25 feet above the floor and 2.3 feet south of the northwest corner. The motif was 0.11 by 0.05 of a foot (fig. 42d).

Wall

Behind Layer 31 was an unevenly surfaced, soot-covered, adobe wall liner on the masonry wall. It was a light-gray with charcoal, gypsum flakes, and other bits of trash in it.

Room 43*

Room 43, which was constructed in the 1600's, was used until the abandonment of the pueblo. Twelve layers of plaster were noted on the north wall, and, according to the field note, "many of the layers have white paint on black."

One layer had two white dots 1.7 feet above the floor, and there were probably more originally. An earlier layer had the remains of a white arrow or lightning symbol, 0.06 by 0.04 of a foot, on a black background. This was on the north wall, 1.1 feet from the west corner and 1.4 feet above the floor (fig. 42e). The 11th layer had white dots and vertical lines in a 10/10/4 pattern, 1.6 feet long and 1.5 feet above the floor.

Room 119

Plaster remained on both walls in the southwest corner of Room 119. On the south the plaster covered an area approximately 2.5 feet long by 1.5 feet wide; it had no decorations. The first layer, which corresponded to Layer 4 on the west wall, fitted into the following sequence. The west wall plaster was 3.5 feet long by 2.0 feet wide and was 2.4 feet above the floor.

Layers 1 and 2

Layers 1 and 2 were a dark color, but ground moisture, soot, and roots made further observations impossible.

Layer 3

A thick coat of soot-covered white paint or plaster, Layer 3 covered the lower portion of the anthropomorphic figures on Layer 4. Layer 3 extended to about 2.6 feet above the floor.

Layer 4

Approximately 2.5 feet above the floor and 2.04 feet north of the corner onthe west wall, on a background of thick, hard, polished, white plaster, were two anthropomorphic figures (fig. 52, see fiche B11). The largest was 0.58 of a foot tall. The figures had slightly elongated red bodies, white featureless faces, and white and red kilts. They appeared to hold something in their raised left arms. The right arms on each was missing.

The first figure had a black line with two white feathers attached to it across the top of his head. There were also black decorations on his kilt. Below him were the remains of one black leg, and still lower was a yellow rectangular element. Extending to his left from behind his back was a white and black element.

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*See Table 7 for trait summaries and Table 11 for color lists for Rooms 43, 119, 168, 205, and 220.

The other figure had "hair"—a clinging back line along one side of his face. One red and black tassel hung from a corner of his kilt, and he wore a black belt.

To the left of these anthropomorphs was what appeared to be a red kilt with a black belt. Attached to its right side was one, and possibly two, unidentified red forms.

Layer 5

On a grayish brown backing, Layer 5 was a thin white coat of plaster showing striations or brush marks. These occurred in groups that were usually horizontal and were 0.2 of a foot wide.

Layer 6

The last layer of plaster, Layer 6, was a grime-coated brown adobe with an incomplete row (2 feet long) of thick white dots and vertical lines on the west wall at the southwest corner. These were approximately 2.8 feet above the floor and had a 6?/4/5?/4 pattern. Behind the plaster was a dark-gray wall liner.

Room 148

Room 148 had plaster on all four walls—nine coats and the wall liner. The outer layer, which was a brown plaster painted with white dots and vertical lines, was covered with soot. The decorations were approximately 1.4 feet above the floor and extended around the southwest corner from the west wall. On the west wall they had a 3/7 pattern. The field notes also say that "the plaster was badly burned and the gypsum paint apparently burned off except against the west wall where fallen roof protected it."

Room 168

Plaster remained on the north, east, and west walls in Room 168, with the walls adjoining the northwest corner having areas of plaster to a height of 1 foot. Below the door on the north wall was an area of plaster 2.2 feet long by 1.5 feet high, as well as several small plaster fragments that had fallen from higher on the wall. This area had been protected by a door slab leaning against the wall, and from it came the only decorations in the room. Only small pieces remained on the east wall, from which no information was obtained, but the plaster seemed to be related to the earliest of the three floors in the room.

Layers 1-7

The top four layers were in very poor condition. The rest were undecorated, soot-covered, brown adobe layers.

Layer 8

Layer 8 was a brown plaster that was decorated with two anthropomorphic figures (fig. 53, see fiche B12) on one of the fragments (which measured 0.38 by 0.29 of a foot) which had fallen from the east side of a door in the north wall. All that remained of the first figure was a black kilt and a white leg. The kilt was decorated with two elements—a red and white decoration near the waist, and a multi-colored white, red, yellow, and turquoise motif near one corner. The kilt was bordered in red and had a white ornament at the other corner. The second anthropomorph was represented by two white legs. The right leg was decorated with a red line on the ankle and a white and black tie, above which the leg was black. On both figures the white and black paints were thick, and brush marks could be seen on the white.

Layers 9 and 10

Layers 9 and 10 consisted of a brown adobe and a soot-covered gray plaster, respectively.

Layers 11 and 12

An undecorated white plaster made up Layers 11 and 12.

Layers 13-17

Layers 13, 14, 16, and 17 were grime-coated, undecorated, brown layers. Layer 15 was a sooted gray and brown, and Layer 16 was on a gray backing.

Layer 18

Layer 18—the adobe wall liner—had decorations on two of the sloughed fragments from the east side of the door. One piece had incomplete red and black motifs on a fragment 0.37 of a foot tall. The other fragment had two white legs of an anthropomorph on a fragment 0.54 by 0.25 of a foot.

Room 205

Plaster remained on all of the walls in Room 205. The north wall had plaster in the northeast corner covering an area 1.5 by 1.7 feet. The east and south walls, however, were plastered their entire lengths, 5.35 by 2.6 feet high and 3.6 by 2.6 feet high, respectively. The west side had plaster in the southwest corner only, 2.4 feet long and 2.0 feet above the floor. A basal patch undulated between 0.05 and 1.6 feet above the floor.

Layers 1-3

Layers 1, 2, and 3 were grime-coated brown adobe layers.

Layer 4

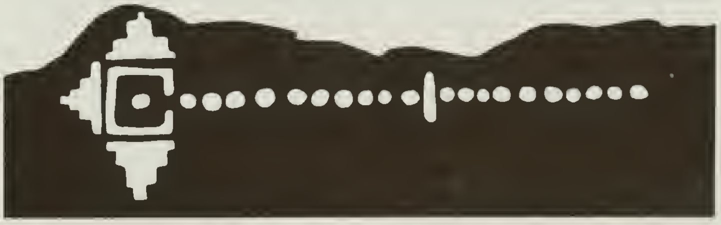
Layer 4 consisted of a blackened white plaster with a gray backing that plugged holes in Layer 5 on the north and south walls.

Layers 5 and 6

Layer 5 was a grime-coated brown plaster, while Layer 6 was a dirty white plaster that looked slightly yellow in some areas.

Layer 7

A grime-coated brown adobe, Layer 7 was decorated on the south wall 4.05 feet from the southwest corner and 1.04 feet above the floor. The designs, which covered an area 1.66 feet long, were formed by variations on the dot theme (fig. 54, see fiche B13). At the western end at least one dot was in a three-sided enclosure formed by double lines. Numerous dots, several with appendages, continued eastward. White paint in various thicknesses and a thin watery black had been used.



☐ White
■ Brown

50. Room 12, west wall.

Layer 8

Layer 8 had a white plaster on a gray backing, which filled holes in Layer 9. There were two small black motifs on the west wall—an arc and a vertical line 1.9 feet above the floor and 1.1 feet north of the southwest corner. They were approximately 0.1 of a foot high and 0.02 of a foot in line width (fig. 42f).

Layers 9 and 10

Layer 9, an undecorated gray, and Layer 10, an undecorated brown, had been discolored by soot and dirt. Layer 10 was on the adobe wall liner.

Room 220

Room 220 was an aboriginal room that had been remodeled for use as a part of the *convento* during the Spanish occupation (see Hayes, 1980). A rectangular limestone block with plaster on one side found in the fill was presumably from the wall. The plaster covered an area 0.89 by 0.17 of a foot.

Layer 1

Layer 1 consisted of a white, hard, fine-grained plaster covered with a thick red paint. One small black line, 0.06 by 0.01 of a foot, was on the red paint. The layer was covered with soot.

Layer 2

Layer 2 was also covered with a thick red paint that was the same texture and color as that on Layer 1. Both were probably a paint rather than a plaster. Layer 2 was coated with grime.

Layer 3

A reddish brown adobe covered with grime constituted Layer 3.

Layer 4

Layer 4, a dirty brown adobe, was decorated with four narrow white lines, 0.01 to 0.02 of a foot long. This was on a backing of ash plaster, partially on the limestone and part on Layer 5.

Layer 5

Layer 5, which was soot-covered, was a thin, hard, fine-grained, white clay plaster on the limestone.

Design and Design Layouts

In every case where enough design remains to permit making a practical judgment, the viewer is struck by the boldness, the simplicity, and the little use of detail in the murals from Mound 7. Presumably, only enough detail was employed to make identification possible to the inhabitants.

There was no apparent attempt at balance or symmetry, although this statement could be misleading. With the limited amount of decorated plaster found, as well as the low heights of the standing plaster, it is possible that in some cases there was an overall balance which cannot be seen now. There was no directional usage of color detected, and although the evidence from the rooms is inconclusive, there is nothing to indicate a directional usage of designs, other than the absence of dots and their accompaniments from the east wall of Kiva N.

In Kiva N the importance of the east wall was indicated by "special" designs—no replastering or replastering only the east wall, and deleting the bands from the east wall (Layers 6, 11, 16, 17, 18, 21, 22, 24, 30 and 31). (The use of the term "east" here is general, and overlaps onto the northeast and probably the southeast sections.) The "special" designs (figs. 29 and 37–41) are found in all the design categories and are discussed therein. Viewed as a group, however, all are distinctive within their own categories.

Designs can be divided into three categories—geometric, pictorial, and unknown. Many of the items considered geometric have possible symbolic meaning, and the pictorial motifs are representational. Where one should classify the designs is arbitrary, and it is possible that someone else would classify them differently.

Geometric

Among geometric designs—the most commonly used motif—the dots and their various accompaniments formed the greatest number. These can be divided into several different groups: linear dots (table 12), linear dots with vertical lines (table 13), linear dots with and without vertical lines associated with small unidentified forms which are closely related to the basic units (table 14), and linear dots with appendages (table 15).

All of these designs were produced in a similar style. White, the predominant color, was usually utilized as a thick paint. In a few cases, however, there was a slight use of red, black, and yellow (figs. 25, 46, 48, 51, and 54; Kiva N, Layer 1, west wall; Kiva N, Layer 9, south wall; Kiva N. Layer 22, east wall).

The dots and their variations are associated with all of the geometric and pictorial style groups, singly or grouped. Within their own groups the various dots and associated forms occur in any combination, with one exception—dots with appendages are always associated with dots with small unidentified forms. The reverse, however, is not true (see table 15 for associations; examples with appendages include figs. 21 and 24). A gradually increasing emphasis on the dots and their accompaniments in the early to late murals in Kiva N indicates a style change that reached its greatest intricacies in the Late Phase rooms.

The most common height above the floor for the dot groups was between 1.04 and 2.5 feet; the extremes were 1.04 feet and 3.16 feet. It should be noted, however, that the upper limits were determined by the edges of the remnant plaster, and dots as well as other decorations may have existed higher on the walls. The dot diameters varied between 0.01 and 1.2 feet, but the majority were less than 0.1 of a foot in diameter. Vertical lines were between 0.1 and 0.09 of a foot wide and 0.09 to 0.28 of a foot long.

Although dots occurred on many prehistoric murals at other sites, none have the same layout, feeling, or variations as those found at Mound 7. Usually, dots occurred as border decorations (Colton, 1939, fig. 7; Fewkes, 1909, p. 52, 1916, p. 107, fig. 2, pl. 17; P.S. Martin, 1936, pl. 60; E.H. Morris, 1928, p. 385; Nordenskiold, 1893, p. 109, figs. 77 and 78; Smith, 1952b, figs. 74b, c, and d, p. 58, figs. 7g and h), and only a few dot and vertical line associations are known (Fewkes, 1911, p. 32; C. Mindeleff, 1897, fig. 73). None have been noted in modern pueblo murals.

One Hopi observer told Smith that white dots at Awatovi (Smith, 1952b, fig. 74a) "represented hail or snow and that there had probably originally been clouds painted along the upper part of the walls" (ibid., p. 314). Some dots in Room 12 (fig. 50) are associated with terraces (clouds), which could be a clue to a possible identification or symbolism. Some of the appendages are reminiscent of growing or sprouting plants, and together, the clouds, the moisture, and the growing plants could imply fertility.

Alternate hypotheses for the dots and vertical lines include calendric systems or a mnemonic device for spoken ritual on the order of the rosary. It is possible, too, that dots are purely decorative in nature, as there is no apparent significance to the number of dots between vertical lines, the number of rows, or their associations, geometric or pictorial. In several cases dots continue around corners (Room 12, Layer 15, and one unnumbered layer in Room 12, northeast corner).

In other media (petroglyphs and pottery decorations), linear dots and vertical lines very similar to those on the Mound 7 murals have been noted: on the Rio Grande west of Albuquerque (James G. Bain, personal communication) and on a Tabirá Black-on-white canteen from Mound 7.

Another commonly used geometric element was a band (table 16). Bands were solid-colored (black, white or yellow) and "spattered white" or multi-colored, with red and yellow used by themselves or in various combinations with black, white, and brown. Bands occurred by themselves or with any of the design groups and categories. Decorations were found above, below, and on the bands. The most common motif occurring on the bands were the dots and the dots and vertical lines (figs. 25, 26, and 34). In addition, bands served as anchor lines for other elements, geometric and possibly pictorial (figs. 24, 26, 27, and 32).

Smith suggested that multi-colored basebands could be rainbows, "since such identification is consistent with modern Pueblo and Navajo ritual art"; he further pointed out that such would be "an imputed symbolism" rather than "a direct representation" (1952b, p. 134). There is no reason why this would not also apply to multi-colored bands higher on walls. Smith also discussed other rainbow shapes, circles, arcs, parallel-sided bands on kilts, and multi-colored "blocks," although not all such motifs are rainbows (ibid., pp. 247-248). Dutton, who quoted Ladd as saying that "the painting of the colored bands is done in most major ceremonies, in the kivas or in special houses at Zuñi," felt that this was also true at Kuaua (Dutton, 1963, p. 170, fn. 507).

The final group of geometric elements, "geometric miscellaneous" (table 17), is composed of everything that is left over: terraces, "enclosures" for dots, triangles, arrows, arcs, spots and dots not belonging to the previously described groups, zigzags, circles, miscellaneous lines and slashes, and other unidentified geometric elements. The most interesting of these are the "enclosures" that are associated with the dots and their variations (figs. 22, 28, 50, and 54). Two are complete specimens, and of the remaining, two have a single enclosure and two are double (one inside the other), and two occur in a line of dots. One of the latter is at the end of a line, but the plaster is too fragmentary to know about the other. From the two complete specimens it can also be observed that the enclosures can be 3- or 4-sided.

The importance and use of terraces as cloud symbols have been well documented (Smith, 1952b, pp. 244-245 and 246). The impression given by Figure 50 is of a place of emergence, in which case the terraces could be symbolic rather than a simple decorative device. This possibility has already been discussed with dots. Other terraces can be seen in Figures 34 and 43.

A motif that is often symbolic is the bent arrow or lightning shaft similar to the one in Room 43 (fig. 42e). According to Smith, "lightning is one of the most commonly represented natural forces in all southwestern ceremonial practice" (ibid., p. 132), and its importance is well known (ibid., p. 248). Another possible lightning symbol is the barbed arrow associated with the first bird on Figure 28.

Triangles, too, have a variety of symbolic meanings–rain, clouds, eyes, butterflies, sex symbols, feathers, water waves, awanyu, and so forth (Fewkes, 1898, p. 9, 1911, p. 32; Kidder, 1915, p. 431, 1931, p. 91; Smith; 1952b, pp. 245 and 307; Stirling, 1942, pl. 16, fig. 2a). All of these motifs can be purely decorative embellishments instead of symbolic.

Pictorial

The second design category is pictorial (table 18) and includes anthropomorphs, miscellaneous items associated with anthropomorphs and religion–zoomorphs, and botanical forms. These groups, although noticeably fewer than the geometric designs, are found in various combinations with them.

Between 14 and 18 costumed anthropomorphic dancers or kachinas are represented in three rooms and one kiva at Mound 7. In this group another significant style change can be seen. Both of the earlier anthropomorphs (from the Middle Phase) were static and conventionzlied (figs. 26 and 32). But in the Late Phase, movement and perspective can be seen, and the figures have taken on a realistic nature (figs. 47 and 53); however, conventionalized forms are still utilized (fig. 52). Two possible anthropomorphs in Figure 44, also in a Late Phase room, are aberrant–not only are they closely related to the "dots" style in technique, form, and manner of application, but they do not fit easily with the other anthropomorphs.

That all of the realistic, moving figures are located in rooms rather than kivas is probably an act of circumstance. There are no murals from the Late Phase in any of the kivas, although there may have been while the kivas were in use. As already noted, some of these Late Phase rooms could have served as kivas. But since these moving, realistic beings did occur only during the late period, and possibly after Spanish contact (when the presence of the Catholic Church was felt), one wonders to what extent this might be due to Spanish influence.

At Awatovi (Room 778) and Kuaua (Kiva 4), any contact between the Spaniards and natives utilizing the decorated kivas and rooms would have been slight (Dutton, 1963, pp. 204-205; Smith, 1952b, table 2, pp. 310 and 317) and did not change mural styles or depictions. The mission of San Bernardo de Aguatuvi was contemporary with the Late Phase at Mound 7 (Montgomery, Smith, and Brew, 1949, p. 47), but, understandably, the art employed was traditional Spanish Church decoration, geometric and conventionalized floral designs (ibid., pp. 60, 297-298), as were the mural remains at San Ysidro at Gran Quivira (Vivian, 1964, pp. 78-79). Smith (1952b) discussed other historic mission murals in New Mexico, and, according to Montgomery, Smith, and Brew (1949, pp. 306-309), even where pueblo art was depicted, it was restricted to geometric and standard symbolic devices; there was nothing to indicate an introduction of perspective and free moving forms into pueblo art at this time. It is possible that the realistic painting of dancers was a response to Spanish efforts to eradicate the Indian religion, and were, in essence, the pictorial substitutes for the dances formerly performed.

Although the differences are noticeable, especailly in arrangement, subject matter, and perspective, the realistic and free dynamic style (for example, Dunn, 1968, figs. 47, 50, 53, 59, 62, 63, 67, 72) used on 19th-century hide paintings is closer to the Figure 47 dancers from Mound 7 than other pueblo materials. The conventionalized figures are of two types: a shield figure (fig. 26), and a stilted almost stylized form (fig. 52). The anthropomorph on Layer 16 of Kiva N (fig. 32) would probably fit into the latter group, but only the lower portion of the torso remained.

There is no doubt that shields were an important element, both prehistorically and historically, in warfare and the religious life of the pueblos and the peoples from the plains, and they have been discussed and illustrated at length (Bolton, 1916, pp. 168-179; Gebhard, 1958, p. 148, fig. 2; Hibben, 1967, p. 86, fig. 4; A.T. Jackson, 1938, p. 343, pls. 242-246, p. 394, pl. 277; Parsons, 1936a, p. 1030; Smith, 1952b, pp. 98 and 238-242; Schaafsma, 1965, pp. 12-14 and 16; Winship, 1896, p. 490). One of the common methods of depicting anthropomorphs with shields has come to be called "shield figures," a stylized or conventionzlied shield with legs, arms, head, weapons, and so forth. Although the figure in Kiva N (fig. 26) is incomplete, there is little likelihood that the circular element with legs could be anything else. The legs are bent, indicating movement, but this feeling is not conveyed to the viewer. It is interesting to note that the concentric circular pattern and colors used are the same as the shields or sun symbols depicted at Pueblo del Encierro (Schaafsma, 1965, pp. 12 and 13).

The second group of conventionalized figures (fig. 52) is completely rigid—in fact, even the raised arms give no feeling of movement. They are full-bodies, simple, roughly angular with parallel sides, and slightly elongated; in style they are closer to the Yei's of 18th-century Navajo art (Schaafsma, 1963, pls. 2 and 4, figs. 53 and 54).

The dynamic realistic dancers in Figure 47 are freely drawn and have a flowing movement. The artist applied his paint carelessly and paid little attention to such anatomical detail as hands. The other realistic anthropomorphs (fig. 53) were so fragmentary that little can be said of them.

The costumes worn by the anthropomorphs, which indicate that the dancers were male, are similar to those at Kuana, Jeddito, and Pottery Mound, as well as to modern pueblo ceremonial dress (Roediger, 1941, pp. 109-174). Masks, body paint, headdresses, sashes, belts, kilts, wrist and arm bands and hangings, mocassins and jewelry are shown. Other possible items of costume include leggings, a medicine pouch, and animal skins.

The figure in Room 168 (fig. 53) had red decorations on his legs, which could indicate leggings. The elaborate multi-colored decoration on his kilt might be a tassel or medicine pouch (see Smith, 1952b, pp. 287-288, and 292). In Figure 47, the white dancer and the black objects with small white protrusions extending from behind the third dancer could be representations of the animal skins that are often attached to the backs of dancers and kachinas (Smith, 1952b, pp. 291-292).

One necklace is clearly indicated—a turquoise pendant with small white circles along its edge on the bi-colored dancer in Figure 46. Other possible pendants, also in Figure 47, are miscellaneous white and yellow spots near the throats of three additional dancers. The third and fifth dancers in Figure 47 and a mask on Layer 11 in Kiva N (fig. 29) have the remains of ear bobs.

Kilts are plain (fig. 47) or have simple decorations, as in the dancers in Figure 52. The red and white design in Figure 53 could represent a kilt decoration. Slightly more elaborate decorations are on a possible kilt in Kiva N. Layer 17 (fig. 37) and on a possible cloak on Layer 18 (fig. 38). These and the plain kilt in Figure 52 are included and discussed in miscellaneous pictorial items. Border decorations are horizontal (figs. 37 and 53), vertical (fig. 52), or a combination of both (fig. 32). There is nothing to indicate material or method of decoration.

Belts are found with kilts (fig. 32, 47, and 52) and without (fig. 47, first, fourth, and sixth dancers). A sash is indicated in Figure 32 by the yellow flange at the side. Tassels are attached to several kilts on the dancer's right sides (fig. 37, 47, and 52). In Figure 53, the white element at the lower right edge could be a stylized tassel. (It is possible that the presence of a tassel could be a stylized method of depicting a dance sash.) The tassels are plain (fig. 53) or two-colored, or divided vertically (fig. 52), horizontally (fig. 47), or solid with dots (fig. 37). Two of the tassels associated with the quiver in Figure 38 are more complicated. These have interior designs, two colors on the fringe and are outlined. The third tassel was divided vertically.

There was nothing to indicate whether body paint or shirts were being represented on the upper torsos of the Room 119 dancers (fig. 52) or on the first person in Room 12 (fig. 47). In Figure 47, the middle four dancers could, it is true, have their entire bodies painted; the bi-colored figure does have a belt on, but he also has what appears to be yellow genitals, which certainly would indicate a painted rather than a clothed body.

On most faces it was impossible to distinguish between simple masks and paint. The dancers in Figure 52 have white featureless faces that were probably face masks, while the kilted dancer in Figure 47 appears to have a case mask with a black rectangular face and red hair. An undoubted mask is portrayed in Kiva N, Layer 11 (fig. 29).

Headdresses included stocking and skull caps with and without feathers (figs. 47 and 52). The mask in Figure 29 has an elaborate stylized peaked headdress with numerous side protrusions that could represent horns or feathers. Several feather arrangements are shown.

A variety of ceremonial items are carried in the hands of anthropomorphic figures in murals of modern pueblos (Roediger, 1941, pp. 145-154) and in those of prehistoric pueblos (Smith, 1952b, figs. 50c, 51b, 65a, 80b, 31a and b; Dutton, 1963, pls. 9, 10, 14-16, 20-22, 24, 25; Hibben, 1955, figs. 59 and 59, 1960, p. 272, 1967, figs. 1, 2, 8). The only identifiable objects held by the Mound 7 dancers—those in Figure 47—are feathers. If other items were being represented, they would probably be similar to those found elsewhere: wands, pahos, evergreens, and so forth. Possibly the dancers in Room 119 (fig. 52) are holding something, but it is difficult to tell where the arms end.

Using ethnological material from the eastern and western pueblos, we attempted to identify the mask and dancers, as well as other objects with similar forms. Particular emphasis was placed on Zuñi (with whom the people at Las Humanas, along with those in the rest of the Rio Grande Valley, had considerable contact) and their neighbors, the southern Tiwa. The northern Tiwa pueblos —Taos and Picurís—were looked into for several reasons:

1. Parsons felt there was a possibility that some of the Isleta inhabitants had originally come in the mid-1600's from Taos (1962, p. 11, fn. 15), which would imply an earlier strong contact between these peoples.

2. Mural reproductions in the prehistoric Picuris kiva showed more similarities to some of the Mound 7 murals than the other contemporary murals at Kuaua, Pottery Mound, and Jeddito. At Picuris simple bold zoomorphic and symbolic devices were depicted (Anon., n.d., p. 6).

3. The northern Tiwa were semi-isolated from pueblos concentrated on the Rio Grande, which made contact with Plains Indian groups relatively greater. Las Humanas was in the same situation.

> Comparisons with the Tiwa produced little. According to Parsons (1936, pp. 114-115):
>
> the center of the Kachina or Masked dance cult is at Zuni whence it spread to the Hopi, to Acoma and Laguna. Among the eastern Keres and at Jemez, still more among the Tewa, it is readily recognized as a marginal cult. At Isleta, apart from the immigrants from Laguna, there is no masked dancing. There are kachina or Tiwane dances but they are maskless. It is, therefore, not surprising to find no kachina masks at Taos and but a single kachina dance . . .

Parsons then offered the alternate hypothesis that the kachina cult at Taos "represents the original cult which came to be highly developed in the western pueblos but remained unchanged at Taos" (ibid., p. 115). In any event, the meagerness of the kachina cult in the east, although perhaps not evident before contact (Anderson, 1955, p. 410) and in early historic times (Hackett, 1937, p. 516 [Index, "Dances"]), along with the reticence of the Tiwa to impart knowledge (Parsons, 1932, pp. 201 and 346; 1936b, p. 5), have not provided the same wealth of information that exists for Hopi and Zuñi.

Considering that kachinas change and are abandoned and replaced in time and space (Bunzel, 1932, pp. 856-857; Dockstader, 1954, pp. 11-13; Smith, 1952b, pp. 293-294), and that "secondary representations" are often depicted in "a simplified and stylized manner" (Smith, 1952b, p. 293), it was doubtful that attempting to correlate prehistoric and contact period personages would meet with a great deal of success. It was a fortunate for Dutton that she had a knowledgeable informant to help with the identifications of the religious personages and ceremonies. Excluding the Kuaua material, relating prehistoric murals to their modern ceremonial equivalents has been slight (Schaafsma, 1965, pp. 14-16; Smith, 1952b, pp. 311-313), and without the help of Zna'ote, Dutton's informant, she would have been greatly handicapped. For example, compare the personage identified as Kohano (Dutton, 1963, fig. 11) with its modern manifestation (Bunzel, 1932, pls. 29b and 31a).

At Mound 7, the white dancer in Figure 47 was the most easily identified. He was remarkably similar to the white personage from Kuaua identified as a "warrior and weed gatherer—dual personage," Kohano, White Salimopiya, Itsepaska, or Anahoho (Dutton, 1963, fig. 11). Dutton related this personage to modern Zuñi ethnology (ibid., pp. 175-176 and 177-178). Although there are noticeable differences in headdress and hair, the main features—white body paint, rectangular element dividing the body, and facial features slightly asymmetrical—are unusual and distinctive.

At Isleta and Taos, several dancers bear superficial resemblances to the Mound 7 Kohano. At Isleta the K'apyo (clown) of the shure' moiety is painted "white all over" and "across the face are stripes of contrasting color"; his hair is tied into a "poke on top of the head," he wears a black breechclout, and he has bundles of twigs tied to the back of his bandoleer and carries yucca whips (Parsons, 1932, pp. 333-334, fig. 22). It is possible that the rectangular element on the white dancer in Figure 47 indicates a breechclout, the black and white element emerging from behind his back is a bundle of twigs, and the object he is holding is a yucca whip.

At Taos, racers that are "nude but for breechclouts" have white paint on their bodies, as well as down stuck on their limbs and hair (Parsons, 1936b, p. 97). The Mound 7 figure has a red knee, which is sometimes indicative of a runner (Barton Wright, personal communication; Bunzel, 1932, p. 996).

The black-bodied dancer with white spots (fig. 47) was reminiscent of Zuñi's Shulawitsi, who is the "boy god of fire and maize and hunting" (Parsons, 1939, p. 175). Shulawitsi is black and covered with multi-colored spots, and except for a breechclout he is nude (Bunzel, 1932, p. 958, pl 25a; M.C. Stevenson, 1904, p. 241, pls. 51 and 62). Similarly marked kachinas performing similar services are known from other pueblos: at Acoma there is Cura'tca (White, 1932, pp. 94-96) or Shua'cha (Stirling, 1942, p. 118, pl. 1), and the Hopi have Ava'chhoya and Masauwu (Smith, 1952b, pp. 310-311).

At Kuaua Shulawitsi is symbolized by a fire torch (Dutton, 1963, p. 54, fig. 61c) or personified (ibid., pp. 113-114, fig. 66, pp. 126-128, fig. 6, p. 172). The Mound 7 personage (fig. 47) has a red object near his left hand, which could be a firetorch. Beyond the possible torch, however, there is no similarity to the Kuaua personages.

A spotted supernatural figure from Isleta is Aiyayaode, who is a wildcat (Parsons, 1932, p. 334; 1962, pp. 264-267). His color is not given, but Parsons' statement that he "looks like antelope" (ibid., p. 334) could be an indication of color, as well as a reference to his distinctive forked headdress. Not enough is known about Aiyayaode, however, to ascertain whether there is a connection with the Room 12 dancer.

At Kuaua there were two laterally bi-colored figures (Dutton, 1963, fig. 27, pl. 30) that were thought to indicate duality and, more specifically, the Twin War gods (ibid., pp. 167-168 and 189). Unfortunately, both figures were incomplete. It is possible that the black-faced, laterally bi-colored (yellow and red) dancer in Figure 47 represents a dual personage.

The incomplete, legless, white-faced dancer at the left end of the Room 12 dance panel (fig. 47) is in front of a yellow-faced personage or attached to him. Both have red torsos, and, if attached, a two-headed personage could be another method of indicating duality. However, no two-headed kachina is known today.

The two remaining dancers in Figure 47 have defied identification, as do the two in Room 119 (fig. 52). The remaining anthropomorphs were incomplete.

It is interesting to compare the anthropomorphs and masks on the murals with other media at Gran Quivira. Faces were carved (Vivian, 1964, 1964, pp. 118-121) or painted on several stones and on Tabirá Black-on-white and Tabirá Polychrome jars and canteens (Hayes, 1980). None of the personages portrayed, however, are the same individuals as those on the murals. They are both full-faced and in profile. The stone portrayals, which are limited to faces, are stylized and conventionalized, while on the pottery the individuals are partial and full-bodied. The masks are conventionalized but realistically portrayed. In contrast, the anthropomorphs are realistic and dynamic, with detail varying from slight to extremely accurate.

The miscellaneous pictorial items include five objects that are more or less associated with religion (table 18). All are from Kiva N and represent the earlier time period (the Middle Phase), and all were grouped in the middle of the layer sequence (layers 11, 16, 17, and 18), which may or may not be indicative of style changes. Here again, due to lack of information and preservation, the answer cannot be demonstrated at Mound 7.

The mask (fig. 29) has already been discussed with the anthropomorphic costumes. However, a few additional details can be added here. It was conventionalized, which is to be expected, and has more detail than the kachina masks from Rooms 12 and 119 (figs. 47 and 52). These masks, of course, are from different time periods, but that probably would not account for the difference. That a single design was used as the main focal point could account for the added emphasis, in addition to the type of mask and the identity of the kachina to whom it belonged. Masks are representations of certain supernaturals, and as such, each contains the power and spirit of the being it represents (Colton, 1947, p. 42; Dockstader, 1954, p. 10; Roediger, 1941, p. 158; Bunzel, 1932, pp. 844-845 and 517). Their use and importance have been discussed at length.

An unknown object accompanying the Kiva N mask (fig. 29) could be part of the headdress of another mask. Unfortunately, so little remains that identification as to category is impossible.

The objects that have been identified as kilts have also been discussed with anthropomorphic costumes. The Kiva N kilt (fig. 37), 1.7 feet above the floor, would have allowed space for legs or a band for a legless figure to rest on. Examples of legless figures can be found at Kuaua (Dutton, 1963, fig. 68) and at Jeddito (Smith, 1952b, figs. 65a and d, 66c, 67d, 81a and b, 84b, 88c, p. 120).

A ceremonial bundle or pouch was located in Kiva N (fig. 33) in immediate association with several unknown motifs that could also be representative of ceremonial paraphernalia. The bundle was composed of three, colored, rectangular units, which formed a larger rectangle. Attached to the side was a string or feather. Similar items have been identified from numerous pueblos: a "small wooden receptacle for the precious ceremonial articles" (V. Mindeleff, 1891, p. 210, figs. 103 and 104), treasure boxes (J. Stevenson, 1883, pp. 392-393, figs. 552-554), stone fetishes wrapped to look like square packages (M.C. Stevenson, 1904, p. 174), kick sticks (Stirling, 1942, p. 122, pl. 14, fig. 2a), square bundles with a "closely analogous function" to prayer sticks (Smith, 1952b, pp. 130-131 and 197, fig. 13a, 1, q, r), feather boxes (ibid., p. 198; J. Stevenson, 1883, fig. 552), a pollen bag or pouch (Dutton, 1963, pp. 76, 91, 115, 141, 146, figs. 88, 56, 60, 41, pl. 14), a dual fetish (ibid., fig. 55, pp. 103 and 159-160, fig. 58), a "tomahawk stone" (ibid., p. 124, fig. 63), a "many colored seeds" pouch (ibid., p. 157, fig. 30), and a "sacred bundle of the katsina leaders" (ibid., p. 164, fig. 24). Despite the variety of names all served religious functions.

The remaining pictorial design (fig. 38) seems to be a shield and a quiver filled with arrows. Although the design is incomplete, another interesting identification is possible: a simplified version of a figure identified at Kuaua as the "universal Diety or Corn (Earth) Mother and Sky (Sun) Father" (Dutton, 1963, pp. 117-119, fig. 54), which resembles Figure 38 in having numerous repetitive decorations on a "cloak" worn by an individual with a filled quiver. At Kuaua this personage appeared on the south wall, but at Mound 7 is was in Kiva N on the east wall.

Although only two examples of anthropomorphs with quivers and without shields can be seen at Kuaua and Jeddito (Dutton, 1963, fig. 54; Smith, 1952b, fig. 53b), numerous examples of zoomorphs and anthropomorphs with quivers and without shields appear at Pottery Mound (Hibben, 1967, fig. 6; also unpublished material). No example of a quiver and shield combination without anthropomorphs or zoomorphs could be found in any prehistoric or modern pueblo murals. However, a jar from Room 9 at Mound 7 depicts a lion-skin quiver full of arrows, isolated from any other design or portrayal.

It is possible that the quiver in Figure 38 was associated with a standing personage—at least plaster fragments above the ventilator suggest a design change. In any event, there is little doubt that the motif referred to as a quiver is indeed a quiver, and accepting this, that the multi-colored protrusions are fletched arrows. The quiver's yellow body with black-tipped tail is indicative of a mountain lion, an animal common on murals (Smith, 1952b, pp. 91, 98, 202-205, 207, 210-211; Tichy, 1947, p. 60; and Pottery Mound, unpublished material). Mountain lion quivers are used in modern pueblo life and ritual (Parsons, 1939, pp. 27, 604, 845; White, 1932, p. 9; 1962, p. 172; Alden Hayes, personal communication, Laguna fiesta).

The three objects below the appendages of the quiver have been referred to as tassels (see anthropomorphic costumes). Since they are different in style from those in Kuaua, Jeddito, and Pottery Mound (Dutton, 1963, pls. 9-12, 14-18, 20, 22, 24, 25; Hibben, 1955, figs. 58 and 59; 1960, p. 2; 1967, figs. 1, 2, 6, 8; Smith, 1952b, pp. 150 and 282-288), other possibilities would be arrows or prayer sticks; these, however, seem doubtful, as the other prehistoric and modern murals have not shown either in a similar circumstance or style.

The zoomorphs were located in Kiva N, where seven, or possibly eight, examples were located on four panels. Four were birds (figs. 28 and 30), two were pronghorn (fig. 21), and one has been tentatively identified as a bighorn sheep or bison (fig. 20). Perhaps the absence of zoomorphs from rooms is indicative of another style change. There does not seem to be the usual association between directions and the animals and birds (Parsons, 1939, p. 365; Smith, 1952b, p. 189) at Mound 7.

Identification of the birds is speculative, although certain characteristics would suggest the possibility that the first bird in Figure 28 is a Yellow-headed Blackbird (*Xanthocephalus xanthocephalus*). However, this species has only one white patch on the wing instead of the three clearly indicated by the artist. The other variation, a brown bill instead of black, is minor (F.M. Bailey, 1928, p. 642). The Yellow-headed Blackbird is located in the general area of Gran Quivira, but it nests only where there is a permanent water supply (Myers, 1923, pp. 121-122). Although there is no permanent water now, nor was there in early historic times, there are periods when the local "lakes" hold water for a season or more (Vivian, 1964, pp. 2-3 and 28)—the Rio Grande across the mountains to the west is a common breeding ground (F.M. Bailey, 1928, p. 643).

Among the workmen at Mound 7 the second bird in Figure 28 was known as "the roadrunner." The long tail feathers with colored markings are characteristic of *Geococcyx californianus*, but the body color should be streaked white, brown, and "bronzy green" (F.M. Bailey, 1928, p. 309). If the bird's head were present, a more positive identification might be made. Roadrunner bones were found at Mound 7, but those of Yellow-headed Blackbirds were not (see McKusick, Part 5).

The identification of the last bird in Figure 28 is unknown. Although the colors are the same as the Yellow-headed Blackbird, the marking on the head is different. With the double dot enclosure and dots overlapping onto its breast, the bird made an unusual appearance. It should be noted that even though the creators of these birds made their "existence from the plant and animal world" around them, they did "live in a world of mysticism and symbolism" (Dutton, 1963, p. 38); thus, the beings portrayed did not have to be living things, but could be symbolic, mythical creatures. The Jeddito murals had several beings that Smith felt could only be explained as "mythical monsters" (Smith, 1952b, pp. 223-225).

The remaining bird (fig. 30) was very reminiscent of a turkey. The turkey occurred in pueblos prehistorically and historically (Schorger, 1966, pp. 31-40), having been identified not only at Mound 7 in great numbers (McKusick, Part 5), but also at Pueblo Pardo to the south (Toulouse and Stephenson, 1960, p. 38). Today the native turkey in the Gran Quivira area is the Merriam Turkey, *Meleagres gallopavo merriami* (F.M. Bailey, 1928, map 8, pp. 231-232 and 234; Ligon, 1961, pp. 103-104). Here again, however, the colors are not quite proper (F.M. Bailey, 1928, p. 231; Ligon, 1961, p. 102). One contributing factor to this is the simplicity of the design and the normal use of the brighter colors instead of the duller tones found on the native turkey, a factor that would also apply to the roadrunner.

If not a turkey, then this bird could conceivably be some tropical bird, but not the macaws that were found at Gran Quivira. The Jeddito murals also had identifiable or semi-identifiable birds that were not marked or colored properly (Smith, 1952b, pp. 183-188).

Of the three, possibly four, mammals (table 18) from Kiva N, the two in Figure 21 were produced in the same thick paint as the dots with which they were associated. Their general conformation–two pronged horns, stubby noses, and short tails–suggests Pronghorn (*Antilocapra americana*) (Hall and Kelson, 1959, pp. 1021-1022; map 495). Pronghorn, it should be noted, were the most common bones located at Gran Quivira (McKusick, Part 5; Vivian, 1964, p. 137), and they occurred at Pueblo Pardo as well (Toulouse and Stephenson, 1960, pp. 36-37); the animals occupy he same areas today.

The remaining quadruped (fig. 20) and possibly his companion, was a humped backed, horned, short-tailed animal that is eminiscent of a Bighorn (*Ovis canadensis*) or a Bison. Bison were eported in the general area by the early Spanish explorers (Bolton, 916, pp. 180-181; Vivian, 1964, p. 12), and the bones of both were found at Gran Quivira (McKusick, Part 5; Vivian, 1964) as well as in previous excavations in the area (Toulouse, 1949; Toulouse and Stephenson, 1960). In addition, these mammals are known from other kiva murals (J.G. Bourke, 1884, p. 132, pl. 25; Dutton, 1963, p. 60, fig. 98, pp. 73-74, fig. 89, p. 122, fig. 63; Parsons, 1936a, pp. 875 and 877; Smith, 1952b, p. 212, figs. 47e, 55a, 58b, 66b; M.C. Stevenson, 1904, p. 438).

The final group contains one and possibly two botanical specimens (figs. 21 and 22) from Kiva N. In Figure 21, the two long, slender, curved leaves and tall stalk with a terminal panicle is probably corn. Too, part of the element at the right edge of Figure 22 bears a slight resemblance to a corn plant lying on its side. Both are associated with linear dots and their usual accompaniments, and are produced in the same style.

Smith has discussed the common use of corn and other plants on prehistoric and modern pueblo murals and altars (1952b, pp. 229-231), and other examples have been recorded from Kuaua and Pottery Mound (Dutton, 1963, pls. 9, 10, 14, 15; Hibben, 1955, fig. 60; also unpublished material).

Unidentified

The final category contains the "unknowns" (table 19), which consists of those scraps of design that are too fragmentary to be identified as geometric or pictorial, or those about which there is some doubt. In addition, areas of "speckled" or "spattered" white paint are included. Comments have already been made regarding some of these, and little can be added here.

The large and irregular area of speckled white paint in Figure 20 appears to be the result of someone shaking a wet paint brush to clean it. Two other areas, on Layer 16, are small and more uniformly made. One is isolated on a brown band but above an incomplete anthropomorph and in the approximate position where a headdress would have been located.

Comparisons and Conclusions

The major recoveries of prehistoric murals, Awatovi and Kawaika-a in the Jeddito Valley, and Kuaua and Pottery Mound in the central Rio Grande Valley, are Pueblo IV and are more or less contemporary with the Pueblo de las Humanas murals. The range in time spanned by the five sites covers a period from the early 1300's to 1672 (Dutton, 1963, pp. 204-205; Hayes 1980; Hibben, 1967, p. 84; Smith, 1952b, p. 316). Other contemporary sites important for comparisons with the Mound 7 murals are Pueblo del Encierro in the central Rio Grande Valley, and Picurís in the Upper Rio Grande drainage (Schaafsma, 1965, p. 7; Herbert Dick, personal communication).

The sudden efflorescence of murals during Pueblo IV times–already well documented (Brew, 1943, pp. 242-243; Smith, 1952b, pp. 68 and 105)–may have coincided with the increased emphasis on ceremonialism and possibly on the kachina cult (Anderson, 1955, pp. 405-406; Brew, 1943, pp. 242 and 244), as well as with the introduction to the eastern pueblos of red, glazed pottery from the White Mountain area (Hayes, 1980).

Using Smith's brief comparison of the Jeddito and Kuaua murals (1952, pp. 150-151) and my personal examination of the Pottery Mound murals, I have compared all three with the Gran Quivira materials. (Comments on comparisons of individual motifs have already been made.)

The Mound 7 murals are simpler and less sophisticated than those at Kuaua, Jeddito, and Pottery Mound, with none of the highly stylized Sikyatki-style designs that are found at the latter two sites. However, since some of the pottery decorations on Tabirá Black-on-white and Tabirá Polychrome pottery from Gran Quivira did have decorations reminiscent of the Sikyatki style (Hayes, 1980), it would appear that the occupants of Las Humanas were familiar with the peoples of Jeddito and Pottery Mound. The

Mound 7 mural portrayals of anthropomorphic activities or ceremonies and ceremonial paraphernalia are not as common as they are at the other three major sites, while such depictions on the local pottery are more common than elsewhere.

At Jeddito, Juaua, and Pueblo del Encierro, it was possible to correlate murals with modern ceremonies; eventually, in fact, we will probably be able to do this with the Pottery Mound materials. This has not been done at Gran Quivira, however. At Kuaua, the Kohano and Shulawitsi were depicted adjacent to one another as participants in a kachina initiation (Dutton, 1963, pp. 170-178). In modern pueblo rituals, of course, these figures perform and associate with many different activities. Although it is possible and probable that they are the same personages as in the Figure 47 panel, their association at Kuaua and at Mound 7 would be slim evidence to identify the dance portrayed as part of an initiation ceremony.

At Jeddito and Pottery Mound, anthropomorphs are depicted full-faced and in profile, and with and without legs, while at Kuaua only one anthropomorph is in profile and one legless. At Gran Quivira, however, most are full-faced, and possibly one personage, at the left edge of Figure 47, is legless. Some of the anthropomorphs at Mound 7 are more stylized than those found elsewhere, while others are more realistic than those seen at other sites. Masks, painted faces, and similar costumes occur at each of the other three major sites.

Mound 7, in addition, does not show the use of detail—expressed as material goods and religious regalia, jewelry, fabric types and decorations, pahos, feathers, pottery, gourds, altars, wall hangings, weapons, and so forth—or anatomical features that are so common at Kuaua, Pottery Mound, and Jeddito.

Another difference involves the use of outlining—there was none at Mound 7, in contrast to that at the three central Rio Grande sites and at Jeddito. At Kuaua and Gran Quivira, too, there were no framing lines dividing the murals into panels as there were at Pottery Mound and Jeddito.

Among all of the major mural collections, there is a variety of zoomorphs in varying degrees of realism and abstractions. At Mound 7 they were both realistic and conventionalized. There are fewer zoomorphs—parrots, snakes, insects, and water creatures (fish, tadpoles, frogs, and so forth)—on Las Humanas murals than elsewhere, but again, these representations are more characteristic of Las Humanas pottery than of any other contemporary ceramics.

Nowhere is there anything like the dots and vertical lines that are so common and important in the Gran Quivira murals. These were repeated over and over again throughout the entire collection, with 25 examples of rows of dots and 30 of dots and vertical lines.

At Jeddito, there were varying degrees of arrangement in the murals, from formal to random. At Kuaua, Smith felt "they are mostly continuous rows of figures, without obvious relation to each other" (1952, p. 151). In view of Dutton's interpretations, however, there was a "plan," in that meaningful elements from specific ceremonies were depicted in order to tell a story. At Pueblo del Encierro and Picuris, the murals were simple and repetitive.

In a complete resumé of modern murals, Smith (1962b), referring to Isleta, reported the mural depictions to be "haphazard" with no "apparent effort to integrate them into a single coherent pattern or picture." This would apply to other modern murals, as well as to the Pueblo IV Picurís material.

At Mound 7 the murals are haphazard, or haphazard but tied together by repetition of a theme or bands (Kiva N, Layers 1, 3, 6, and 16, possibly Room 12, Layer 15). Also, there are planned or "special" designs that occur on the east wall on partial or complete layers (Layers 11, 17, 18, 21, 24, 28, and 36). In style and design layouts, the Gran Quivira murals would fit somewhere between the Pueblo IV (as represented in the Jeddito, Pottery Mound, and Kuaua) and modern wall depictions.

Little has been said regarding Plains influence. Contemporary art, such as hide or bone paintings and pictographs, is sparse, and not until the florescence of Plains culture in late historic times can materials for comparisons be found. The similarity between the dancers in Figure 47 and in 19th-century Plains has been mentioned, but it is not possible to demonstrate that this was a result of Plains influence. Hide paintings from the plains were reported by Coronado in the 1500's (Winship, 1896, pp. 558 and 560), but according to Dunn (1968, p. 145), they may have been quite different in "subject and design."

As more prehistoric murals are uncovered, and as interpretations are more readily available, the murals' importance in interpreting migrations, cultural affiliations, and origins of the kachina cult and pueblo ceremonialism will be increased. At the present time, interesting clues are being revealed—for example, the connections between Pottery Mound, Zuñi, and Hopi (Hibben, 1960, p. 268), and between Kuaua and Zuñi (Dutton, 1963, pp. 205-206), as well as the relationships between Zuñi and Las Humanas (Hayes, 1980). These are all important, and the possibilities for further studies are many.

5. The Faunal Remains of Las Humanas

Charmion R. McKusick

Introduction

The excavation of Mound 7, Gran Quivira National Monument, yielded a vast amount of faunal material. The purpose of this report is to weld the data derived from identification studies in each faunal category into a firm basis for future investigations. Although in a group endeavor of this sort it is not possible to include all the theories advanced by each member, an effort has been made to achieve a consensus of interpretation.

Investigators contributing faunal identifications are listed in order of the appearance in the text of their field of study.

Marine Mollusks
    Leo G. Hertlein
    Curator of Invertebrate Paleontology
    California Academy of Science
Freshwater Mollusks
    Allyn G. Smith, Associate Curator
    Department of Invertebrate Zoology
    California Academy of Science
Insects
    Floyd G. Werner
    Department of Entomology
    University of Arizona
Fish
    William J. Koster
    Department of Biology
    University of New Mexico
Reptiles
    William G. Degenhardt
    Curator of Amphibians and Reptiles
    and
    Arthur E. Dunham
    Assistant Curator
    Department of Biology
    University of New Mexico
Birds and Mammals
    Charmion R. McKusick
    and
    Jerry Greene
    Southwest Archeological Center
    Confirmation of worked mammal bones:
    Thomas W. Mathews, Chief
    Preservation Laboratory
    Southwest Archeological Center
    Confirmation of worked bird bones:
    Lyndon L. Hargrave
    Assistant Research Professor of Ethnobiology
    Prescott College

Modern comparative specimens of rare birds were loaned by Richard L. Zusi, Associate Curator, Division of Birds, Smithsonian Institution; Lyndon L. Hargrave, Assistant Research Professor of Ethnobiology, Prescott College; Stephen M. Russell, Curator of Birds, and Amadeo M. Rea, Department of Biological Science, University of Arizona.

Natural Resources

> "And the said Father Fray Antonio Aguado knows very well what is suffered there for lack of water, because even in the rainy season ponds or pools cannot be made, for it is sandy ground and the water is absorbed" (Nicolás de Aguilar, 1663, in Adams and Chavez, 1956).

In Aguilar's time, as now, the most striking characteristic of Gran Quivira is its continual shortage of water. The pueblo is situated on a blue limestone outcropping in a broad interior drainage basin with no flowing streams; the basin sinks to the east, however, which does offer an intermittent source of potable water. The heavy rains of July and August were once conserved in clay-lined cisterns nearer the pueblo. These, along with shallow wells, provided a scant supply which was adequate, if meager, in the early days of the pueblo, but which became a source of serious dispute during Gran Quivira's last days.

Second to the lack of water is the wind, which blows continuously. Hot and dry in the summer, it keeps the grass of the basin brown and sere for the greater part of the year. At an elevation of 6,600 feet, the winter wind is bitterly cold, penetrating to the marrow or carrying in fog that covers everything with hoar frost (Carleton, 1854).

As hostile as this environment seems, there were nevertheless resources that made Las Humanas a functioning community until famine—caused by drought, upheaval resulting from disputes between the clergy and the civil officials, and the depredations of the Apaches invited by the pueblo's exposed position on the eastern periphery—combined to bring about the collapse of the economy.

Located on the southeastern periphery of the pueblos, Gran Quivira was in an excellent position for trade with the Jumanos of what is now Texas (cf. Bolton, 1916, frontispiece map). Salt, ever a desired commodity, was obtainable from the Salinas to the east. The dry basin grassland supported a rich fauna of rabbits, jackrabbits, prairie dogs, and smaller rodents, which attracted, in turn, such predators as coyotes, eagles, and the larger hawks. The area is still suitable for herds of pronghorn, which were the dominant form throughout the life of the settlement. Although nearly exterminated in the late 1800's, bison were also of primary importance to the inhabitants of Las Humanas, and should have been present in small herds in this area (Shelford, 1963, p. 4).

The Gallinas Mountains, between 15 and 20 miles to the east, and Chupadero Mesa to the west and south apparently supported some White-tailed Deer and the larger predators. Large Mule Deer inhabit the ridge country bordering the mountains.

Intermittent pools of water may have attracted migrating or wintering waterfowl in good years, but a more dependable source of waterfowl and associated forms was the Rio Grande, about 45 miles to the west.

The only pre-Conquest domestic animals were the dog, and far more important, the turkey. These probably did not strain the existing water supply, but it was soon found that the larger introduced domestic animals attached to the mission consumed such a great quantity of water that it was impractical to keep them at Gran Quivira, at least not in any number beyond what was necessary for immediate needs (cf. Vivian, 1964, pp. 2 and 3).

The faunal resources available to the inhabitants of Las Humanas are considered in the following pages in taxonomic order, from simpler forms to those that are more complex. Tables provide technical data such as minimum faunal count and percentage constitution of collections.

Marine and Freshwater Mollusks

> "The river flows toward the east. The water is clear and good. . . . The river [the Middle Concho in Texas] flows to join that of the pearls. It also has shells, ..." (Juan Dominguez de Mendoza, 1684, in Bolton, 1916, pp. 334 and 335).

Molluscan Faunal List

Latin Name	Common Name	Unworked	Worked
Mollusca sp.	Unknown mollusk		x
Gastropoda sp.	Snail-like univalves	x	x
Vermetidae sp.	Vermetid gastropods		x
Nassarius sp. (cf. *N. iodes*)	Dog welks		x
Olivella sp.	Olivellas		x
Olivella dama Mawe			x
Olivella gracilis Broderip & Sowerby			x
Olivella anazora Duclos			x
Conus sp.	Cone shells		x
Conus gladiator Broderip			x
Pelecypoda sp.	Bivalves		x
Arca sp.	Ark shells		x
Arca multicostata Sowerby			x
Glycymeris maculata Broderip			x
Pinctada sp.	Pearl oyster		x
Pinctada mazatlanica Hanley			x
Chama sp.	Rock oysters	x	x
Unio sp. (cf. *U. houstonensis* Lea, cf. *U. aurea* Lea)	Freshwater mussel	x	x
Lampsilis sp.	Freshwater mussel		x

Marine shell is a trade item valued by the Indians of the Southwest from two millenia ago into the historic period. As such, it has long been used by archeologists to trace prehistoric trade routes and to give some approximation of direction and intensity of cultural contacts.

Only three fragmentary specimens of marine shell that do not bear some marks of alteration were recovered from Mound 7. Since they are species that appear in the collection as beads or pendants, it may be that they are actually fragments of worked shell that, by chance, do not bear smoothed edges or perforations.

As is common in other Southwestern sites of this period, the identifiable marine shell originated, with a single exception, in the Gulf of California. This one exception, *Arca multicostata,* is found on the western coast of Mexico, and today ranges as far north as San Diego (P. A. Morris, 1951, p. 10).

The non-marine shell specimens recovered from Mound 7 are all pearly mussels. These freshwater mussels were brought in through trade; as early as 1898 Simpson recognized that no heavy-shelled Unionidae were "known to inhabit North America west of the great Rocky Mountain chain, this being the largest area destitute of *Unio* life in the temperate or tropical regions of the globe" (quoted in Henderson, 1929). Both genera of mussels represented at Gran Quivira probably came from Texas. The Concho and Colorado River drainages are the closest source for pearly freshwater mussels, and one of the identified species is found in Texas only. Recent pollution of rivers has greatly restricted the distribution of these naiads, but they were formerly abundant.

The Spanish sent several expeditions into the land of the Jumanos: Father Salas' in 1629, Captains Hernando Martin and Diego del Castillo's in 1650, Diego de Guadalajara's in 1654, and Captain Juan Domíngues de Mendoza's in 1683. Whereas Mendoza approached from the southwest because of the recent Pueblo Rebellion, the others had entered what is now Texas from the northwest, usually following the drainage of the Rio Colorado to the Jumano settlements–probably a long established trade route. From the various accounts, it is apparent that the focus of exploration was the Concho River and the Rio Colorado in present-day central Texas. Shells were reported to be plentiful, and the Spanish envisioned a trade in pearls which seemed promising at the time, but which failed to develop.

Notes on the Worked Shell Collection

Mollusca sp.: 133 specimens, 39.90% of the collection
Many disc beads were recovered which are altered to such an extent that no original surfaces remain. The greatest bulk of these was fashioned from thick, white, porcelaneous shell like that of large pelecypods. One lot of smaller beads, which has been worked from thinner shell, resembles the fine conus shell beads still made at Santo Domingo Pueblo.

Gastropoda sp.: 5 specimens, 1.50% of the collection
The shells of unidentified gastropods are all snail-like. One has the form of an olive (*Oliva* sp.), while another with an incomplete whorl is shaped like a cone (*Conus* sp.).

Vermetidae sp.: 2 specimens, less than 1% of the collection
The two specimens of worm gastropod shell from Gran Quivira are well-polished short sections of tube with no original color pattern remaining. Other shells of vermetid gastropods have been recovered from Swarts Ruin, New Mexico, and from the Hohokam Classic period of Los Muertos in Arizona, but these date earlier than the occupation of Mound 7. Occurrences at Pecos and Zuñi, however, are contemporaneous with those at Las Humanas (Tower, 1945, p. 21).

Nassarius sp.: 29 specimens, 8.750% of the collection
A single string of these minute Dog Welk shells constitutes a deceivingly large percentage of the collection. They are referred to *N. iodes,* a species common in the northern part of the Gulf of California (Keen, 1958, p. 412). Some preparation of this form may have been done at the shore, since the apices of the spires of all nassarius shells were ground off. It cannot be argued that this was done for the purpose of stringing (as is possible in the olivella), however, since the spiral is so tight in this species that the whorl must be perforated for attachment. It seems more likely that the apex of each tiny shell was ground off on a stone at the beach, and, with the vacuum thus broken, the inhabitant was flushed out quickly and easily in the water. Other methods of cleaning these small shells are difficult and time consuming. If shells are not cleaned at once, the decomposing animal is not only lastingly odorous, but may also produce discoloration.

Olivella sp.: 47 specimens, 14.10% of the collection
Many olivella shells have been burned in cremations, making them unidentifiable to species. As far as can be determined, all were strung as beads.

Olivella dama: 28 specimens, 8.40% of the collection
Olivella gracilis: 6 specimens, 1.80% of the collection
Olivella anazora: 1 specimen, less than 1% of the collection

O. dama, by far the most numerous olivella in the Mound 7 collection, is especially common at the head of the Gulf of California (Keen, 1958, p. 424). Most shells from Gran Quivira have lost their color through time, or have been calcined in cremations, but a few of these specimens still retain a violet tint set off by brown markings. *O. gracilis* is uncommon, ranging no farther north than Guaymas, Sonora, in modern times.

Mound 7 olivellas total 82 specimens, representing 24.60 percent of the collection. Not only is this genus the best represented at Gran Quivira, but it is also continuously represented in Southwestern archeological shell collections from Basketmaker II into the historic period.

Conus sp.: 8 specimens, 2.70% of the collection
Like the olives, cone shells are most often used as tinklers in the Southwest. Except in the Hohokam area this genus occurs infrequently before A.D. 1100, becoming increasingly common in later sites. As rock dwellers these animals do not inhabit the sandy environment occupied by olives, olivellas, clams, cockles, moon snails, and drills, and they may have been overlooked.

Conus gladiator: 1 specimen, less than 1% of the collection
Cone shells of several species are found in the Mound 7 collection, but only one specimen could be readily identified.

Pelecypoda sp.: 28 specimens, 8.40% of the collection
The pelecypods consist of artifacts and broken bits of the valves of both marine and freshwater forms. Many appear to be fragments of pearly freshwater mussels.

Arca sp.: 2 specimens, less than 1% of the collection
Arks have exceedingly durable shells suitable for use as pendants, but they are uncommon in Southwestern archeological shell collections. As mud dwellers they are not found in the same environment as the more commonly utilized species.

Arca multicostata: 1 specimen, less than 1% of the collection
Of the entire Mound 7 collection, only one marine species, the Many-ribbed Ark, is not found in the Gulf of California. It inhabits the west coast of Mexico, extending as far north as San Diego, California (P. A. Morris, 1951, p. 10).

Glycymeris maculata: 5 specimens, 1.50% of the collection
Archeological literature contains a number of confusing and conflicting references to this small glycymeris. Brand, in 1938, considered it a separate species; Tower, in 1945, combined it with *G. gigantea*; then, in 1965, Kean again treated it as a separate species. *G. gigantea* is the large glycymeris, up to 4 inches across, the shell of which is made into bracelets. *G. maculata* has more prominent radial striae and a finer pattern, and grows to only 35 mm. across. Its shell is suitable for small pendants, as at Mound 7, or for finger rings.

Pinctada sp.: 2 specimens, less than 1% of the collection

Pinctada mazatlanica: 1 specimen, less than 1% of the collection
The only pinctada listed for the west coast or Gulf of California is *P. mazatlanica*, a heavy, dark-colored pearl oyster.

Chama sp.: 1 specimen, less than 1% of the collection
One specimen of rock oyster shell was identified by comparison of the hinge. It also contains the cast of one of the lithophages that often invade the thick walls of these shells (cf. Violette, 1964, p. 68). Another specimen, a rough "figure-8" bead, has none of the original surface remaining, but carries the deep rose pigmentation characteristic of *C. buddiana*.

Unio sp. (*Quadrula* sp.): 24 specimens, 7.20% of the collection
All of these mussel shells are of the thick-walled type found east of the Rocky Mountains.

Unio houstonensis: 1 specimen, less than 1% of the collection
This species, now listed as a *Quadrula*, is native to Texas, Louisiana, and southern Arkansas. Another suggested species, *U. aureus* (now *Quadrula aurea*), is found only in Texas (Simpson, 1900, pp. 782 and 783).

Lampsilis sp.: 5 specimens, 1.50% of the collection
Lampsilis is a genus of pearly freshwater mussels that is considerably thinner valved than *Unio* (*Quadrula*). Specimens from Gran Quivira could have come from eastern Kansas, Oklahoma, or more probably, Texas (Murray and Leonard, 1962, pp. 142-154).

Summary

The most striking characteristic of the Gran Quivira shell collection is the use of pearly freshwater mussels during the Middle and Late Phases. The absence of these mussels from the Early Phase sample may be a factor of small sample size. The thinner *Lampsilis* valves are perforated for suspension, with the nacreous lining exposed. The thick *Unio* shells had the periostracum and the crystalline prismatic layer removed so that both sides are irridescent.

Although the aggregate of identified freshwater mussel specimens totals only 9 percent of the collection, these forms constitute 16.11 percent of all occurrences. The beauty of the pearly white or glowing golden pendants must have made most of the marine shell articles appear drab by comparison. Approximately 65 percent of the shell collection is composed of tiny beads, roughly 40 percent disc beads and 25 percent whole shell beads. The decorative effect of beads, although great in number, was of a much less conspicuous nature than that provided by the pearly freshwater mussel shell items. In order to provide some estimate of units of use, worked shell is tabulated by the number of occurrences rather than by the number of specimens (table 20).

The comparative paucity of marine shell from the west tends to suggest that Las Humanas was at the end of a trade route from that direction. The absence of the shells of *Glycymeris gigantea* and *Haliotis*, in any form, may indicate that the more desirable items were removed from trade before they could reach this area. Shell was rare; if broken, it was reworked, and every tiny fragment saved. Kidder (1932, pp. 183-194) reported that thousands of marine shells were found at Pecos. Even there, however, broken bits of marine shell were used in ceremonial caches rather than discarded. This conservation of every scrap for use in offering caches is indicative of the value placed on shell throughout the Southwest at all periods, as well as of the relative scarcity of the commodity at Las Humanas.

Freshwater shell appears to be insignificant in Southwestern sites, until the eastern periphery is examined. Most of the thousand or more discarded fragments from the trash of Pecos were the thin edges or hinge portions of freshwater mussels. Kidder believed these to be of local origin, which may be, since *Lampsilis* is mentioned as heavier-shelled. Heavy-valved pearly mussels are conspicuous in the Late Phase collection from Mound 7. Although Kidder found thin-shelled mussels in the Indian occupation at Pecos, thick-shelled mussel was found in the *convento*. Some thick-shelled mussel was known in pre-Columbian times, as attested to by one specimen of *Quadrula* from Rainbow House (Caywood, 1966, p. 36), but present evidence indicates a more active trade in this commodity, from what is now Texas, in early historic times.

One factor that has made the study of shell recovered from Southwestern archeological excavations difficult, and at times inconsistent, is the persistent assignment of species to "coasts" rather than to their proper provinces—and in many cases the coast designation does not coincide with the biological province. The California Province stretches from Washington south to Lower California. The Carolinian Province extends from Cape Cod, across northern Florida, through Texas. Both provinces are inhabited by cool-water species. Tropical species, on the other hand, are found in the Panamic Province, which runs from the Gulf of California to northern Equador, and in the Caribbean Province, which includes southern Florida, the east coast of Mexico, and northern South America (Abbott, 1962, pp. 14, 15, 18, 19). Thus, all the marine species identified from Mound 7 are from the Panamic Province, with none originating in the Gulf Coast of Texas or the eastern coast of Mexico (P. A. Morris, 1951). Further, most of them appear to have come from the northern part of the Gulf of California.

Insects

Insect Faunal List

Latin Name	Common Name	Unworked	Worked
Insecta sp. (cf. Lepidoptera or Diptera)	Unknown insect	x	
Muscidae sp.	Fly	x	

Based on his ethnozoological studies, White reported that insects are of little importance to modern Pueblo Indians (L. A. White, 1945, pp. 223-243). Some use of an insect motif, such as the dragonfly, is found on recent pottery, and the Butterfly Dance still has many participants, but the use of insects as food or ornamentation among Pueblo Indians is minor, if present at all. The most important prehistoric use of insects, for which there is archeological confirmation, is the utilization of lac as an adhesive. Mimbres pottery designs picture beetles, butterflies, grasshoppers, and a weevil-like insect with a proboscis. One bowl design depicts what appears to be an agricultural scene of men plucking insects from a corn-like plant and impaling them on sticks (Nesbitt, 1931, pls. 24A and 26; Bradfield, 1929, pls. LXXVI and LXXVIII; Cosgrove and Cosgrove, 1932, pls. 120, 192, 196-199, 228).

The Spanish chroniclers described a wide variety of animals familiar to the inhabitants of what is now New Mexico, but beyond Castañeda's comments on lice (Hammond and Rey, 1940, p. 265), little mention was made of insects. Evidently flies remained unnoticed until a more fastidious Bourke complained of them and various other vermin in his accounts of visits to New Mexico pueblos during the 1880's (J. G. Bourke, 1936, p. 259).

Only two samples of insect materials were recovered from the excavation of Mound 7. The first, identified as Insecta (probably order Diptera or Lepidoptera), consisted of parts of a large puparium. It was recovered from Burial 34, under Room 9. This was a Middle Phase extended burial of an "elderly" woman, 42 to 50 years old. Surrounding the body were the remains of rotted vegetal material, probably matting. Some tissue remained on the blackened ribs and vertebrae, and it was here that the fragments of insect material were found. It seems more probable that a large flesh fly invaded the wrappings of the body before burial than that a butterfly pupa was involved.

The second sample consisted of many fly puparia of the family Muscidae, which were found in the rotted corn fill of Room 62, a Late Phase storage room. Both samples of insect material appear to have arrived at their location in Mound 7 through normal feeding activities rather than having been brought there by man.

Fish

> "There are also many rivers containing a great abundance of fish, and there are large *esteros*. There is especially the Rio del Norte, which, when its waters are lowest and we are able to ford it, reaches the saddle; but when it is swollen from the water it receives from the melted snows alone, its current is rapid and strong. The same is true of the other little streams which flow into it. All of them contain a very large number of catfish, trout, silvery chub, eel, shovel-nosed sturgeon, *matalotas*, suckers, gar pike and many other kinds of fish" (Fray Alonso de Benavides, 1630, in Forrestal, 1954).

Fish Faunal List

Latin Name	Common Name	Unworked	Worked
Lepisosteus osseus	Longnose Gar	x	

Two samples of fish bone from the excavation of Mound 7 are identified as the Longnose Gar (*Lepisosteus osseus Linnaeus*). All the bones are from the snout and lower jaw, with only the anterior portions of bones extending back of the mouth present. A total length of 500 mm. is suggested for these individuals (William J. Koster, personal communication, 1969).

The Longnose Gar is an easily recognized fish, long of body with needle-like teeth set in slender, tapering jaws. It is known in the Pecos north to about Roswell, but in the Rio Grande, it now occurs only in Texas. Formerly, it may have ranged farther up the Rio Grande, but there is as yet no proof to support this (Koster, 1957, p. 22; personal communication). One indication that the Longnose Gar occurred farther up the Rio Grande is the former distribution of the Shovelnose Sturgeon (*Scaphirynchus platorynchus*). Although this species is apparently now extinct in New Mexico, several specimens were taken in 1874 near Albuquerque (ibid., p. 23). This primitive ganoid prefers the channels of the same rivers, which harbor gars in the quieter waters along the banks. If sturgeon were available in the Albuquerque area, gar might also have been present.

As interest in the recovery and identification of faunal remains grows, small samples of fish are being reported from an ever-increasing number of sites. However, actual remains of the Longnose Gar are still limited. The excavation of Sand Dune Cave on the northeast side of Navajo Mountain produced nine gar scales, lying in close proximity as if they had been originally attached to the fish skin, which were found above the pelvis of Burial 1 (Lindsay, Ambler, Stein, and Hobler, 1968, pp. 44 and 63). Parts of the lower jaw and 25 gar scales were recovered from the excavation of Kin Kletso, a Pueblo III site in Chaco Canyon (Vivian and Mathews, 1965, pp. 22 and 23). Judd (1959, pp. 35, 127, 128) eported seven gar scales from the trash fill of Room 44A at Pueblo del Arroyo, a site near to, and in part contemporaneous with, Kin Kletso. The right palatine of a Longnose Gar has been identified from Room West 2 of Pottery Mound, Rio Puerco, New Mexico R. R. Miller, personal communication, 1963).

Correlating these occurrences in time with phases assigned o Mound 7, the earliest sample is from a Basketmaker II burial at Sand Dune Cave; three samples from Chaco Canyon correspond to he last third of the eleventh century; one sample from Pottery Mound is contemporaneous with the Early-Middle Phases; and two amples from Mound 7 itself are probably Late Phase, perhaps even ost-1600.

Another factor in the consideration of the gar specimens is the presence of only head parts, from the mouth forward, and scales. While the possibility that gars were eaten cannot be overlooked, it seems strange that vertebrae or other bones have not been found, as they have been for more common fish such as boneytails and suckers. The distance of all gar-producing sites (except Pottery Mound) from rivers in which this species might be found casts doubt on their use as food. The suggestion by Vivian and Mathews (1965) that gars may have been stuffed in a manner similar to the Gobernador raven skins, described later, certainly gains strength in light of the elements recovered and the distribution in time and space that parallels similar usage of bird remains.

Three gars are represented in great detail in the kiva mural decoration at Kawaika-a (Smith, 1952b, figs. 55a and 60b), and murals at Kuaua portray the sons of the Sun, each wearing a headdress representing the decapitated body of a large fish of unknown species (Dutton, 1963, pp. 180-182).

Gars are pictured in the pottery of the Mimbres Valley from both Cameron Creek Village (Bradfield, 1929, pl. LXXIII, no. 128 and pl. LXXVII, no. 40) and Swarts Ruin (Cosgrove and Cosgrove, 1932, pls. 207, 208, 209). One bowl from Swarts Ruin portrays a man bearing a feathered standard with a crossbar from the ends of which are suspended a large fish of unknown species and what appears to be a coati. The artist must have seen such a contrivance actually used, since the coati is placed nearer the standard so that it will not overbalance the lighter fish. The standard is held up and out, implying a lightness such as would occur if the creatures were stuffed skins rather than whole carcasses (Cosgrove and Cosgrove, 1932, pl. 228).

Reptiles

Reptilian Faunal List

Latin Name	Common Name	Unworked	Worked
Terrapene ornata	Ornate Box Turtle	x	x
Chrysemys picta	Painted Turtle		x
Crotalus sp.	Rattlesnake	x	

Reptiles have a prominent place in the life of Southwestern Indians. Turtles are depicted on Mimbres pottery (Bradfield, 1929, pls. LXIX and LXXIII; Nesbitt, 1931, pl. 26; Cosgrove and Cosgrove, 1932, pls. 201, 203, 204), and are associated with water in recent pueblo tradition. Among modern Pueblo Indians, rattles made from the shells of small turtles are fastened to the legs of ceremonial dancers just below the knee. Although Navajos may sometimes eat turtle, they more often use the shell as a medicine cup or as material for beads (Franciscan Fathers, 1929, pp. 214, 407, 507).

Snakes appear in kiva murals, sand paintings, and slat altar screens, as well as in the Hopi Snake Dance.

Notes on the Faunal List

Terrapene ornata: minimum faunal count–definitely identified 17, referred 7, 92.31% of the collection

The Ornate Box Turtle is small, with an average adult measuring 4 to 5 inches in carapace length. The Mesa Jumanes is located on the periphery of the range of this species, at the line of transition from the eastern form, *T. o. ornata*, to the southwestern subspecies, *T. o. luteola*–which modern residents of the Gran Quivira area do not recall seeing. It is unlikely that *T. o. luteola* was in the immediate vicinity of Las Humanas in prehistoric times, since it is not found above an altitude of 6,000 feet even in extreme southern Arizona and New Mexico. Those specimens recovered from Mound 7 could have originated in more southern or eastern grasslands. Ornate Box Turtles, in fact, are seldom observed in arid regions. The necessity of avoiding overheating and desiccation requires that they spend a large part of their lives in underground burrows. The eastern form will soon languish and die under arid conditions, but the southwestern subspecies is able to grow and prosper, even though it ventures out to feed only during the brief moist periods following rains. At these times, remarkable numbers of turtles appear and may be captured easily while they are crossing open areas (Legler, 1960, pp. 533 and 539-541; Stebbins, 1954, pp. 171-174).

Chrysemys picta: minimum faunal count–1, 3.85% of the collection

Unlike the land-dwelling box turtles, the Painted Turtle is closely restricted to shallow, quiet water. Active during the day, it may be seen basking on rocks, logs, or the surface of the water, only to disappear beneath the surface when disturbed. Occasionally, it may wander considerable distances overland, sometimes accompanied by other members of its own species, but most feeding is done underwater. It is larger than the Ornate Box Turtles, with adults of the western subspecies, *C. p. belli*, ranging from 7½ and 9¾ inches (Stebbins, 1954, pp. 174-177).

Crotalus sp.: minimum faunal count–1, 3.85% of the collection

The single snake recovered from Mound 7 is identified simply as rattlesnake. A large number of rattlesnakes inhabited Mound 7 before excavation, and all were the Prairie Rattlesnake, *Crotalus v. viridis*. Prairie Rattlesnakes frequently inhabit the burrows and eat the young of both the Prairie Dog and the closely associated Burrowing Owl (Conant, 1958, pp. 195 and 196).

Discussion

The Ornate Box Turtle occurs through all phases of Mound 7, and is represented by fragments of carapace and plastron as well as by leg bones, indicating that at least some were transported to Las Humanas intact and were processed there. There does not seem to be any deliberate modification of turtle bone, such as shaping or the drilling of holes for suspension. However, two specimens do bear evidences of use-polish. A fragment of box turtle carapace is smoothed along the outer margin as though from rubbing over a long period of time. The only specimen of Painted Turtle is a fragment of plastron bearing wear-facets along the outer margin, which formed after it had been separated from the carapace at the ventral end of the bridge. The Painted Turtle sample is referred to the Middle or Late Phase. A rattlesnake found on the floor of Room 23 is dated at about A.D. 1672.

Mound 7 Birds

> "There are numerous cranes, geese, crows and thrushes which feed on the planted fields" (Pedro de Castañeda de Najera, 1540, in Hammond and Rey, 1940, p. 255).

Latin Name	Common Name	Unworked	Worked
Aves sp.	Unknown bird	x	
Podiceps caspicus	Eared Grebe	x	
Pelecanus erythrorhynchos	White Pelican	x	
Olor columbianus	Whistling Swan		x
Branta canadensis	Canada Goose	x	x
Anser albifrons	White-fronted Goose	x	
Chen hyperborea	Snow Goose	x	
Anas platyrhynchos ssp.	Mallard or Mexican Duck	x	x
Anas acuta	Pintail	x	
Anas carolinensis	Green-winged Teal	x	
Anas cyanoptera	Cinnamon Teal	x	
Mareca americana	American Widgeon	x	
Bucephala calangula	Common Goldeneye		x
Cathartes aura	Turkey Vulture	x	x
Accipitridae sp.	Unknown hawk	x	x
Accipiter gentilis	Goshawk	x	
Accipiter striatus	Sharp-shinned Hawk	x	
Accipiter cooperii	Cooper's Hawk	x	
Buteo sp.	Unknown buteonine hawk	x	x
Buteo jamaicensis	Red-tailed Hawk	x	x
Buteo swainsoni	Swainson's Hawk	x	x
Buteo lagopus	Rough-legged Hawk	x	x
Buteo regalis	Ferruginous Hawk	x	x
Aquila chrysaetos	Golden Eagle	x	x
Haliaeetus leucocephalus	Bald Eagle	x	x
Pandion haliaetus	Osprey		x
Circus cyaneus	Marsh Hawk	x	
Falco mexicanus	Prairie Falcon	x	x
Falco peregrinus	Peregrine Falcon	x	
Falco columbarius	Pigeon Hawk	x	
Falco sparvarius	Sparrow Hawk	x	
Odontophorinae sp.	Scaled or Gambel's Quail	x	
Callipepla squamata	Scaled Quail	x	
Cyrtonyx montezumae	Harlequin or Mearns Quail	x	
Gallus gallus	Domestic Chicken	x	
Meleagris gallopavo	Small and Large Indian Domestic Turkey	x	x
Grus canadensis	Sandhill Crane	x	
Grus canadensis canadensis	Lesser Sandhill Crane	x	x
Grus canadensis tabida	Greater Sandhill Crane	x	x
Fulica americana	American Coot	x	
Zenaidura macroura	Mourning Dove	x	
Ara macao	Scarlet Macaw	x	
Geococcyz californianus	Roanrunner	x	

Latin Name	Common Name	Unworked	Worked
Bubo virginianus	Great Horned Owl	x	x
Speotyto cunicularia	Burrowing Owl	x	
Asio otus	Long-eared Owl	x	
Asio flammens	Short-eared Owl	x	
Chordeiles minor	Common Nighthawk	x	
Eremophila alpestris	Horned Lark	x	
Progne subis	Purple Martin	x	
Corvus corax	Common Raven	x	x
Corvus cryptoleucus	White-necked Raven	x	
Corvus brachyrhynchos	Common Crow	x	
Gymnorhinus cyanocephalus	Pinyon Jay	x	
Catherpes mexicanus	Canyon Wren	x	
Sturnella sp.	Meadowlark	x	
Carpodacus mexicanus	House Finch	x	
Fringillidae sp.	Sparrow	x	

All bird bone segregated in the initial sort of the Mound 7 collection has been examined. A faunal count of 2,298 includes four individuals so immature that they cannot be assigned to family; they are recorded as Aves sp.

Since the evidence suggests that these birds were more desired for feathers for use in socio-religious activities and for the manufacture of feather cord blankets rather than for meat, no attempt has been made to compute yield of usable food.

Special Usages

During the identification study of the bird bone collection from Mound 7, three groups of intentionally altered bone were segregated, which, so far as is known, have not been previously reported. A search was made of all identified avian material stored at the Southwest Archeological Center to determine if isolated examples of these types of alteration had been noted from other sites. Occurrences of all three groups were found, and their frequency of occurrence was about the same as that at Gran Quivira, but the samples of bird bone from which the three groups were drawn are so small that these isolated instances had not previously been recognized as constituting definable groups. In fact, the first evidence observed in the Mound 7 collection so closely resembles the refuse left by modern ornithologists in making bird skins that the expedition led by James Hamilton Gaut, which collected birds at Gran Quivira on 27 and 28 September 1903 (F. M. Bailey, 1928, p. 31), seemed a logical source. When the proveniences of the specimens were checked, however, it became apparent that these are indeed aboriginal products.

Data are still insufficient to put definite labels on these new categories. They will be treated here in a very tentative manner, with descriptions, distribution so far as is known in time and space, and suggested ethnological parallels. Hopefully, further research will yield enough additional material to either substantiate or modify these impressions.

"Fetishes"

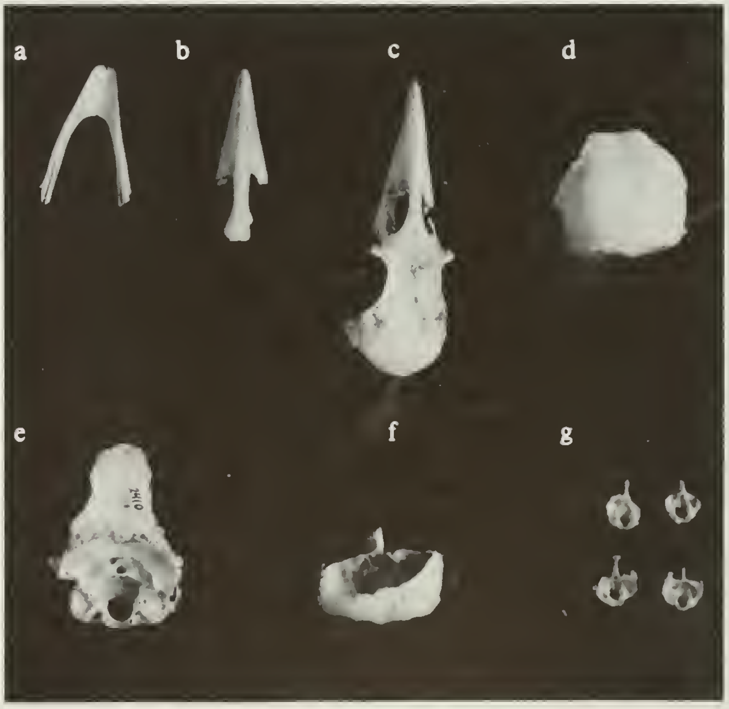
Thirteen specimens, 12 Common Raven and one Common Crow, are included in the "Fetish" classification. This type of artifact consisted of the premaxilla and the interorbital area of the frontals (fig. 55d). Hester (1962, pp. 114 and 118) illustrated three raven skin fetishes that were recovered from pots cached in caves in the Gobernador district of New Mexico. These fetishes, which are on display at Mesa Verde National Park, were examined in February of 1970. Meredith M. Guillet, the General Superintendent, reported that although there is no evidence of leg bones, the wings seem to be present on the exposed sides of the paired birds. When the heads were probed with a fine needle, greater resistance was encountered in the area above the beak and between the eyes. The head of a modern study skin is much larger than that of the Gobernador specimens, at least one of which contains one or more pieces of hard wood in the body cavity. The extensive wrapping of cords around the fetishes precludes a detailed examination of the filler material.

A specimen similar to those from Gran Quivira was recovered from excavations at Atsinna in the Cíbola area; it dated A.D. 1200-1400, and another from Los Aguajes near Santa Fe dated about A.D. 1400-1500. Specimens from Mound 7 are contemporaneous, dating between A.D. 1300 and 1540.

"Scratchers"

The premaxillae of three Common Ravens from Mound 7 seem to have been employed as "scratchers," or, in some similar manner, to have acquired use-polish on the anterior tip. Whatever their use it must have continued over a long period of time, as the horny covering of the beak would have had to wear off before the use-facets could have formed on the bony core. Hester (1962, p. 119) and the Franciscan Fathers (1929, p. 372), reported the use of raven or crow beaks as scratchers in the "Enemy Way," a sing that is described in detail by Laura Gilpin in *The Enduring Navajo* (1968, p. 235). On the last night, the patient emerges from the ceremonial hogan carrying the "scratcher" in his hand. With it, he repeatedly jabs at the ashes representing the slain enemy. This symbolic devouring of the fallen foe by the scavenger bird concludes the ritual.

A similar specimen was found at Bc51 in Chaco Canyon, dating perhaps A.D. 1000-1100, and two from Puaray date about A.D. 1400-1540. Occurrences at Mound 7 (fig. 55b and c) span the entire occupation, from A.D. 1300 to 1672.



55. Worked bird skulls and beaks.

The occurrence of a raven cranium with premaxilla deliberately removed at Bc51 in Chaco Canyon brought to mind the bird remains recovered by Pepper (1920) from Room 38 of Pueblo Bonito. This room, rich in what is judged to be ceremonial paraphernalia, also contained burials, droppings, and the massed bones of Scarlet Macaws, which, from all evidence, died caged or otherwise restrained there. Also mentioned are the remains of jays, variously reported as Steller's or Pinyon Jays, which were presumably also caged. It has always seemed illogical that these birds would have been confined together. As cavity nesters, adult macaws are capable of demolishing wooden constructions with amazing rapidity and obvious relish. It is therefore customary to raise nestlings by hand, training them to confine their activities to their own perches. Evidence that this practice was carried on in aboriginal times is illustrated by both pottery (Nesbitt, 1931, pl. 23) and wall paintings (Hibben, 1967, pp. 84-87), and is discussed in some detail in the Florentine Codex (Dibble and Anderson, 1963, pp. 22-24).

The presence of the "jays" was explained in 1967 when the bird bone from Pueblo Bonito was borrowed from the American Museum of Natural History by Lyndon L. Hargrave for examination during his study of the Mexican macaws. Upon inspection it was found that the "jays," in reality, consisted of four premaxillae and four mandibles mixed with the incomplete skeletons of a number of small mammals. These were identified in 1967 by Hargrave as the beaks of four Black-billed Magpies *(Pica pica).* Fortunately, these specimens were retained for further study, and are still on deposit at the Southwest Archeological Center.

Upon re-examination, it is apparent that both the premaxilla and mandible were cut from the head at the juncture of the cuticle covering the beak proper and the skin which bears the feathers. Both premaxillae and mandibles are compressed laterally, indicating that the upper and lower beak were bound tightly together near the point at which they were severed from the carcass. Since there were no other bird bones beside those of the macaws and a lone left ulna of the Screech Owl *(Otus asio),* we must include our "jays," actually magpies, with the ceremonial paraphernalia found in the room rather than with the live birds.

The establishment of the presence of both the upper and lower beak as a unit of use, at least in four cases, leads us to other sites and times. The Franciscan Fathers (1929, pp. 407 and 408) mentioned as an adjunct of the Knife Chant the use of two wrapped and feathered crane bills—one straight to represent the female, the other curved to represent the male. Although the bill of the Sandhill Crane is preferred, that of either the Great Blue Heron or the "Twigbill Crane" may be substituted for one bill if two Sandhill Cranes are not to be had. An archeological occurrence similar to this usage is a premaxilla and mandible of the Lesser Sandhill Crane recovered during the excavation of Arizona W:10:50 near Point of Pines in east-central Arizona. As in the magpie beaks recovered from Pueblo Bonito, wrapping is implied by the strong lateral compression of both the lower and upper beak.

Whether these usages of water birds are related to the use of the beak specimens from Gran Quivira is not possible to determine at present. The other occurrences are all corvids, and all black or mainly black in color. There is, however, indication of pueblo origins for modern Navajo usages, which are further reflected in the following discussion of "bird skins" (cf. Vivian and Mathews, 1965, pp. 17-22).

"Bird Skins"

A larger and more heterogeneous group of intentionally altered bone has been designated as "Bird Skins." At Gran Quivira it is composed of 16 assorted buteonine hawks, eagles, harriers, and falcons. The remains most often consist of the premaxilla and cranium, in which an aperture had been cut, presumably to remove the brain. This aperture may be made by neatly slicing off the occipital area, by enlarging the foramen magnum, by removing the floor of the brain case, or by an oblique chop across the skull. In some cases only the occipital portion of the skull was recovered. Occipital portions are illustrated in Figures 55e, f, and g.

When enough of the vault is present for examination, saggital cutting scars may be found. It appears that the skin of the head was slit longitudinally, and the brain removed. Although it might seem reasonable that the brain was removed for the sake of preserving the bird head—perhaps for use as an ornament on a ceremonial wand or headdress, as pictured in early American portraits of Indian leaders—nine of the Common Ravens presently classified under "Fetishes" had had the occipital area of the cranium cut off, as well as the beak and frontals. This would suggest that the brains themselves may have been desired for some purpose.

Guernsey and Kidder (1921, p. 102) pictured the stuffed skin of a Yellow-bellied Sapsucker (*Sphyrapicus varius*) from Cist 24 in White Dog Cave, a Basketmaker II site. A later indication of this artifact type is a specimen from a site about 12 miles southwest of Chaco Canyon National Monument (Archeo-ornithology files, Southwest Archeological Center), which dated A.D. 1000-1200. Occurrences span the entire occupation of Mound 7, but are most numerous during the Late Phase, which is contemporaneous with two occurrences from Pueblo Pardo.

A similar specimen was recovered during the 1968 excavation of archeological sites on Amchitka Island, Alaska. Although all specimens from the Southwest are from various hawks or eagles, this specimen was made from a cranium of the large subspecies of the Common Raven, *Corvus corax principalis,* which is found in that area (personal communication, Amadeo M. Rea, 1969). Ravens are prominent in the art and tradition of the Northwest Pacific Coast, and may have been prepared as skins in a manner similar to those further south.

Information gathered to date indicates that the "bird skin" type of artifact may prove to be more widespread than the other two categories, and may be more numerous in east-central New Mexico after A.D. 1500.

Worked Bird Bone

Most bird bone working at Gran Quivira was directed toward the production of three types of tubes: a very short tube with length about equal to the diameter, a medium tube about half the length of the bone shaft, and a long tube employing nearly the whole shaft. Some tubes are further altered to form flutes and whistles. The selection of species with long wing bones or with very long, straight leg bones reflects this usage.

Only three awls are included in the worked bird bone collection, probably because of the plentiful supply of durable artiodactyl bone, which is better suited for heavy-duty implements.

Birds dependent on a water habitat constitute a rather large segment of the species utilized for artifacts, accounting for six of the 14 identification categories, but only 11.75 percent of the collection. This low usage level of a wide variety of species may suggest either a lack of selectivity or that these were trade items entering the culture from elsewhere. Birds from an aquatic habitat are few in both worked and unworked bone collections, but constitute a greater percentage of the worked bone than the unworked bone collection, implying deliberate selection. Although waterfowl and marsh birds could have been obtained from a large sink near Las Humanas which held water into historic times, the presence of marine shell and the Longnose Gar at Mound 7 suggest a trade route to the west, perhaps reaching the Rio Grande via Abó Pass.

The fluctuation in frequencies of species utilized for the production of tools in the Early and Middle Phases may be more a function of sample size than actual change, but the comparison of turkey bone artifacts with those made from the bones of hawks and eagles should be reliable. The turkey, often conspicuous in collections of bird bone tools, drops in frequency from 20 percent in the Early Phase, to 15.38 percent in the Middle Phase, to 12.92 percent in the Late Phase. Conversely, artifacts made from bones of hawk-like birds aggregate 60 percent in the Early Phase, 69.22 percent in the Middle Phase, and 74.12 percent in the Late Phase. Uneven sample size for the three periods of Mound 7 occupation make it impossible to determine whether there was an actual phasing-out of turkey bone artifacts, or whether turkey usage remained constant, and hawk and eagle usage increased slightly. In either case, the reduction in the percentage of turkey bone artifacts and the increase in the percentage of hawk and eagle bone artifacts are of a different order. Evidently, the supply of turkey bone had little to do with its use for artifacts, reinforcing the assumption that the primary purpose in keeping large numbers of these birds was feather production, perhaps mostly consumed in the utilitarian production of feather-cord robes. The hawks and eagles, however, do not appear to have been employed for any strictly utilitarian purpose; their use for socio-religious purposes, for articles of adornment, and for the production of items of trade would not necessarily be influenced by the same factors that determined utilization of turkeys.

In comparing the percentage compositions of the worked and unworked bird bone collections (tables 21 and 22), a positive selection for tool stock may be observed in all categories except Prairie Falcons, turkeys, and Common Ravens–that is, percentage values for the worked bird bone exceed those for the unworked. Two species, the Whistling Swan and the Osprey, are not represented in the unworked bird bone collection.

Nature of the Specimens

Mound 7 yielded vast numbers of fortuitous splints of bones that had been used once and discarded. These fragments, in which the only alteration is from the wear incurred during a short duration of use, and where there is no deliberate shaping or choice of element used, are included with unworked bone.

Cut-off ends of bone discarded in the manufacture of artifacts of a standard, recognizable type are considered under worked bone. Such cut-off ends of bone in a collection of faunal remains tend to support manufacture at the site rather than importation of the finished products.

Notes on the Collection

These notes are organized under assigned taxonomic headings resulting from identification studies. Even though worked and unworked bone are discussed as a unit under each species, percentage composition is listed separately for each to aid both the ecologist and the archeologist. Unless otherwise indicated, all occurrences of species at sites other than Mound 7 are derived from the Avian Crossfile in the Southwest Archeological Center.

Grebes and Pelicans

Podiceps caspicus: minimum faunal count–1, less than 1% of the collection

The Eared Grebe is represented by a fragmentary tibiotarsus.

Pelecanus erythrorhynchos: minimum faunal count–1, less than 1% of the collection

The White Pelican, represented at Gran Quivira by a right coracoid, has also been identified from Awatovi in Arizona; Rainbow House, Bandelier National Monument, New Mexico; and Casas Grandes, Chihuahua.

Swans, Geese, and Ducks

Swans

Olor columbianus: no unworked specimens

[Artifacts: 2 specimens, less than 1% of the worked bird bone

The Whistling Swan appears elsewhere among artifacts from Las Madres Pueblo and Aztec Ruin in New Mexico, and Tuzigoot Pueblo, Arizona; all are sites located on water.

Geese

Branta canadensis: minimum faunal count–4, less than 1% of the collection

[Artifacts: 2 specimens, less than 1% of the worked bird bone

Both artifacts were cut from ulnae.

Anser albifrons: minimum faunal count–6, less than 1% of the collection

Chen hyperborea: minimum faunal count–11, less than 1% of the collection

Of the three species of geese identified from Mound 7, the Canada Goose and the Snow Goose are still common migrants. The White-fronted Goose, although better represented in the archeological collection than the Canada Goose, is now extremely rare. Of 21 samples, 20 consisted of wing or leg bones.

Dabbling Ducks

All five species of surface-feeding ducks identified from the Mound 7 collection are common migrants. Mallard/Mexican Ducks and Cinnamon Teals are also available in the Rio Grande Valley as nesting birds. Of 12 samples, 10 consisted of wing bones, one a leg bone, and one the major elements, except the head, of an American widgeon.

Anas platyrhynchos ssp.: minimum faunal count—6, less than 1% of the collection
[Artifacts: 2 specimens, less than 1% of the worked bird bones

Both artifacts were made from wing bones, one humerus, and one ulna.

Present thinking on the Mallard/Mexican Duck problem has placed the differentiation of these waterfowl on a subspecific level. Both the female-plumaged Mexican Duck, which is believed to be the primitive pattern, and the familiar, dimorphic, green-headed mallard would have been available to the inhabitants of Gran Quivira, but we cannot at present differentiate these plumage groups on the basis of skeletal elements (cf. Johnsgard, 1960, pp. 3-43; Phillips, Marshall, and Monson, 1964, pp. 12 and 13).

Anas acuta: minimum faunal count 3, less than 1% of the collection
Anas carolinensis: minimum faunal count—1, less than 1% of the collection
Anas cyanoptera: minimum faunal count—1, less than 1% of the collection
Mareca americana: minimum faunal count—1, less than 1% of the collection

Diving Ducks
Bucephala calangula: minimum faunal count—1, less than 1% of the collection

Diving ducks are represented by a single ulna of the Common Goldeneye. The feeding habits of diving ducks require deep, preferably clear, permanent water, which precludes their presence in the area of Las Humanas.

Vultures, Hawks, and Eagles
Cathartes aura: minimum faunal count—11, less than 1% of the collection
[Artifacts: 1 specimen, less than 1 % of the worked bird bone

The Turkey Vulture, a ubiquitous carrion-eater, would have been available to the people of Las Humanas at any time during the warm season. The only bones recovered fom Mound 7 are wing elements: five ulnae, four humeri, a radius, a carpometacarpus, and a coracoid. The cut-off head of an additional humerus was the only artifact. Since vulture bone is so light and pneumatic that it is used infrequently for tools, this suggests that the Turkey Vulture may have been valued mainly for its feathers.

Accipitridae
Accipitridae sp.: minimum faunal count—4, less than 1% of the collection

Three of these individuals are represented by specimens too fragmentary to identify any further than simply "hawk." However, the fourth is a nearly complete skeleton of a medium-sized hawk not represented in our comparative collection. There are several genera of Mexican hawks in this size range.

Accipiter Hawks. Accipiters are bird-hunting hawks that attack their prey from ambush rather than pursuing them over open country. The preference of Cooper's Hawks for quail undoubtedly brought them into the area of Gran Quivira more often than the Goshawk and the Sharp-shinned Hawk. All Goshawk and Sharp-shinned Hawk specimens are wing bones, but six of seven samples of Cooper's Hawk include leg bones. This shy, retiring genus was apparently not nearly as important as the bolder buteos; none were used for artifacts.

Accipiter gentilis: minimum faunal count—1, less than 1% of the collection
Accipiter striatus: minimum faunal count—2, less than 1% of the collection
Accipiter cooperii: minimum faunal count—7, less than 1% of the collection

Buteonine Hawks. With the exception of turkeys buteonine hawks are the largest generic group identified at Mound 7. With a minimum faunal count of 768, they constitute 33.79 percent of the collection. Those recovered from Mound 7 were nearly all youthful, with the fenestra in the interorbital septum still open. At this age many individuals would still have worn the banded feathers that later change to the more easily separated plumages of the full adult.

The inhabitants of Gran Quivira utilized the four large buteonine hawks available to them in direct proportion to the length of time that each species was present in the area—that is, Ferruginous and Red-tailed Hawks, which are resident, are well represented; Swainson's Hawk, a migrant, is less numerous; and the Rough-legs, which are only winter visitors, are least numerous of all.

Buteo sp.: minimum faunal count—46, 2% of the collection
[Artifacts: 73 specimens, 34.31% of the worked bird bone

Of the 46 individuals from Mound 7 assigned to the *Buteo* species, only two were immature. The remaining 44 are root-eroded, rodent-gnawed, or too fragmentary to yield a reliable specific identification.

Red-tailed and Ferruginous Hawks constituted the greatest part of the artifact sample. Tubes are cut from the humerus, radius, ulna, femur, and tibiotarsus. One radius and a fibula have been used as awls.

The buteonine hawk and eagle bone used for artifacts at Mound 7 is unusually large. More eagles and hawks fall in the upper limits of the female size range, which is the larger among hawks. However, refuse bone includes specimens of both male and female size range. It is possible that the larger, stockier bones of the females were preferred over the gracile bones of the males for artifacts, but the difficulty of judging the bone size of a fully feathered bird suggests that trade in artifacts from an area of higher altitude or latitude, where the bird population would normally run larger, may be more probable (cf. "Bergmann's Rule," Van Tyne and Berger, 1959, p. 359).

Buteo jamaicensis: minimum faunal count—269, 11.84% of the collection

Buteo swainsoni: minimum faunal count—129, 5.67% of the collection

Swainson's Hawks at Las Humanas are members of a small population similar in size to modern specimens from east-central Arizona. Specimens of this species identified from Las Madres Pueblo in the Galisteo Valley are much larger in size, comparing more closely with specimens recovered from excavations at Picurís Pueblo.

Buteo lagopus: minimum faunal count–23, 1% of the collection

Buteo regalis: minimum faunal count–301, 13.24% of the collection

Ferruginous Hawks are the largest buteonine hawks found in New Mexico. They were formerly very numerous over their preferred mesa-plains habitat (Ligon, 1961, p. 69), and this is reflected in their occurrence at Gran Quivira, where they are second in number only to turkeys. Although the Ferruginous Hawks are quite large in comparison to the Red-tailed Hawks and other buteos, they do not exceed the upper size limits of modern comparative specimens. Particularly conspicuous are the short, stocky shanks and extremely long wing bones of the specimens falling within the female size range.

Eagles. Eagles and buteonine hawks are usually represented at Mound 7 by the entire skeleton, in contrast to Picurís Pueblo, another site on the eastern periphery of the Southwest where samples more commonly include only the wings and legs. Many Gran Quivira wing and foot bones are scarred at the joints where connecting tendons were severed. Ulnae were cut from humeri, tarsometatarsi were removed from tibiotarsi, and the toes were severed from the tarsometatarsi. These cuts would produce a wing-feather fan, a shank with a foot, or separated toes. Some unguals were cut loose from the toe, producing a separate claw such as is still used for jewelry.

Caudal vertebrae and pygostyles of eagles and hawks are extremely rare, with only three appearing in the entire Mound 7 collection. One of these pygostyles is part of the nearly complete skeleton of a Prairie Falcon. It would have been easy to twist off the tail fan of feathers with this supporting pygostyle midway up the caudal vertebrae, but apparently this procedure was not always followed. One Mound 7 eagle clearly shows cuts, first from the sides to the posterior margin of the synsacrum, and then from ventral to dorsal, separating the tail with an attached handle of vertebrae suitable for mounting. The low frequency of pygostyles, when many smaller bones were present in great numbers, suggests the possibility that they may have been part of an item traded out of the area.

The crania of hawks and eagles, as well as those of some other birds, were utilized at Mound 7. Because of the many species involved, they are considered under "Special Usages" (previously discussed).

Aquila chrysaetos: minimum faunal count–196, 8.62% of the collection
[Artifacts: 77 specimens, 36.19% of the worked bird bone

Unworked specimens of Golden Eagle bone recovered from Mound 7 are in some cases very large, but the majority fall within the range of the larger modern comparative specimens. Most individuals were youthful. Today's Pueblo Indians utilize the immature plumage of both Golden and Bald Eagles in preference to that of older birds. At this stage both species have mottled rectrices that are white at the base and dark at the tip (Arnold, 1954, p. 5).

The most numerous species represented in worked bird bones–Golden Eagles–are approached only by the combined buteonine hawks. Thirty artifacts were worked from the ulna, 19 from the humerus, 13 from the femur, seven from the radius, six from the tibiotarsus, and two from the mandible. These last are mandibles with the articular processes removed; they appear to have been used as ornaments (fig. 55a).

Haliaeetus leucocephalus: minimum faunal count–8, less than 1% of the collection
[Artifacts: 4 specimens, 1.88% of the worked bird bone.

There was probably very little water in the vicinity of Gran Quivira during the colder months to have attracted this winter visitor, and the Bald Eagle would have been more common along the Rio Grande. Samples from Mound 7 include the trunk as well as the wings and legs, and are mostly of small, male size range.

Artifacts were worked from two ulnae, a humerus, and a radius. Both large and small individuals were included.

Harriers

Circus cyaneus: minimum faunal count–13, less than 1% of the collection

Although harriers are deceptively small-bodied for their wing and total length measurements (Ligon, 1961, p. 75), the individuals recovered from Gran Quivira are even smaller than would be expected from the size range of modern comparative specimens. This may indicate a preference for the smaller, more distinctively marked males. Samples consist mostly of wing and leg bones.

Osprey

Pandion haliaetus: no unworked specimens
[Artifacts: 1 specimen, less than 1% of the worked bird bone

The Osprey is represented by an ulna cut to form a long tube. This species has not appeared before among bird bones, worked or unworked, examined at the Southwest Archeological Center.

Falcons

Falcons recovered from Mound 7 are most often represented by wing or leg bones, and seldom by the axial skeleton. Like the buteonine hawks, the species are utilized in proportion to their availability, the resident Prairie Falcons and Sparrow Hawks appearing in far greater numbers than the Peregrine Falcon and Pigeon Hawk, which are only seasonally available.

Falco mexicanus: minimum faunal count–58, 2.55% of the collection

Many Prairie Falcons from the Mound 7 collection are larger than modern comparative specimens, overlapping the Peregrine Falcon in size even though separable in character and proportion. Although well represented at Las Humanas, and present at a number of sites in northern Arizona and New Mexico from the 1100's on, this species is now rare.

Falco peregrinus: minimum faunal count–11, less than 1% of the collection

Falco columbarius: minimum faunal count–5, less than 1% of the collection

Falco sparvarius: minimum faunal count–52, 2.29% of the collection

Present-day Indians fasten tassel-like bunches of Sparrow Hawk feathers to ceremonial apparel and equipment.

Gallinaceous Birds

Quail

Random bones of two species of quail have been recovered from Mound 7. Although no quail have been identified from pottery at this site, Mimbres bowl designs depict a number of quail-like birds. In one design, a man appears to be calling birds with a whistle; three are caught in snares, while a fourth snare is still empty. The birds are not plumed, indicating that they may be Scaled Quail–the species most numerous at Mound 7 (Crimmins, 1930, pl. 22).

Scaled Quail near Gran Quivira are on the upper margin of their present altitudinal range. The Harlequin or Mearns Quail are now found only in the southwestern part of New Mexico, although F. M. Bailey (1928, p. 225) indicated an earlier breeding and resident range that included mountain areas adjacent to the Mesa Jumanes. The single specimen of Harlequin Quail from Mound 7 could have been carried a short distance, but more probably it represents a wider distribution in the past.

Callipepla squamata: minimum faunal count–11, less than 1% of the collection

Cyrtonyx montezumae: minimum faunal count–1, less than 1% of the collection

Domestic Chickens

Two of the Domestic Chickens recovered from Mound 7 are immatures, and the other four are adults. The bones of these birds, along with those of a specimen from House A of Gran Quivira and one from Cuyamungue near Santa Fe, New Mexico, are gracile with small articular heads. These chickens are of the light, slender body type characteristic of high egg production breeds. In size and conformation, they most closely approach the modern White Leghorn–our only widely raised, modern representative of the Mediterranean breed (Jull, 1927). The Primitive Multicolor Bantam is much the same size, but, like the Game Fowl it so closely resembles, it is of the English type, heavier bodied and heavier boned.

Schufeldt (1909, pp. 175 and 176) pointed out the groove in the median line of the cranium and the raised area underlying the base of the comb that help distinguish male crania in *Gallus gallus.* From what can be determined from crania and tarsometatarsi, the chickens available for study from archeological sites are predominantly females. This, of course, is to be expected, as a high egg production breed would normally be utilized in a predominantly female laying flock. At Mound 7, two immature chicken specimens were recovered in addition to an egg, so there must have been at least one rooster in the *convento* flock, although none are known to have been mentioned in contemporary sources. Supplies were sent to the missions of what is now New Mexico under the combined jurisdiction of the Crown and the Franciscan Order. The 1631 shipment included "four dozen hens for those who may be sick during the journey" (Scholes, 1930, p. 120).

The distal condyles of the tibiotarsus of one specimen from Mound 7 are scarred by cuts made to disjoint the feet, reflecting European food usage.

Gallus gallus: minimum faunal count–6, less than 1% of the collection

Turkeys

Meleagris gallopavo: minimum faunal count–944, 41% of the collection

[Artifacts: 27 specimens, 12.69% of the worked bird bone

Artifacts worked from turkey bones were made in all three phases at Las Humanas. That they were worked from fresh bone is indicated by the skeleton of a large adult male that was intact except for the removal of the humeri, an ulna, and a section which had been cut from the distal shaft of the left tibiotarsus. Tarsal splints were present, indicating that the desired bones had been removed and the carcass discarded with the meat still on it. Of the 27 artifacts, 11 had been worked from the tibiotarsus, eight from the humerus, five from the ulna, and three from the femur.

This sample seems rather small in comparison to hawk and eagles. From the evidence of the unworked bone collection, great numbers of turkeys were kept by the people living at Mound 7, and they would have been more readily available than birds of prey–if their bones had been considered desirable.

Small Indian Domestic Turkey

All but one of the turkeys recovered from Gran Quivira's Mound 7 are of the Small Indian Domestic breed, which has, to date, been identified only from excavations of the Tompiro sites of Gran Quivira and Pueblo Pardo and surface material from Tabirá. The mummy of a turkey recovered by Walter Hough in 1905 from Tularosa Cave near Reserve, New Mexico, has been examined, and from what could be determined of the skeletal structure of the feathered bird and other bones found with it, it cannot be distinguished from the Small Indian Turkey of Gran Quivira. Diagnostic traits shared by these specimens include a very short tarsus and a coracoid that is deeply notched along the sternocoracoidal process. On the basis of the Tularosa specimen, another mummy from Canyon del Muerto and the skeletal material from Mound 7 at Gran Quivira, A. W. Schorger (1970) has named a new subspecies, the Tularosa Turkey (*Meleagris gallopavo tularosa*). These small turkeys, with their short shanks, feathered necks, and perhaps rather humped backs, represent a subspecies that is now extinct. The mummy from Canyon del Muerto is dated at A.D. 250, and that from Tularosa Cave at about A.D. 1100. What appears to be the same breed was introduced at Gran Quivira in the late 1200's in an already standardized domestic form that did not change discernably from the Early through the Late Phases (Schorger, 1961, pp. 138-145; 1966, p. 150; 1970, pp. 168-170). The bones of this breed are not only small, but exceedingly gracile. They resemble neither the Rio Grande Turkey nor the Merriam's Wild Turkey skeletons available for comparison. All archeological turkeys from the Southwest examined so far are distinct from Mexican Turkeys, which represent not only another subspecies (*Meleagris g. gallopavo*), but another center of domestication (Schorger, 1963).

Gizzard Stones

So far as can be determined, all the gizzard stones recovered from Mound 7 came from the Small Indian Domestic turkeys raised there. Although some are scattered around the site—indicating disturbed deposits, or perhaps in very late times, the discards from an eviscerated bird—many were found in the corn storage rooms with bits of eggshell and turkey bones. Additional specimens were recovered with eggshell and turkey bones from the layer of light-colored, decomposed material underlying the unit cornered by Rooms 118, 120, 122, and 127, and extending outside Room 121. A minimum of 55 birds is represented.

Over three-fourths of the stones are jasper, with the remainder chalcedony (the local limestone was also observed, but not collected). Since these silicates are not available at the site, it may be that the turkeys picked up fragments resulting from the manufacture of stone tools. This explanation is strengthened by the unusual sizes and shapes that occur. Some gizzard stones are obvious flakes, many are more angular than usual, and the size range lacks the uniformity generally found in gizzard stones. A sample of gizzard stones found *in situ* in a turkey skeleton includes fragments of stone up to 15 mm. in their greatest dimension; a maximum size of 8 mm. is more usual. Whether grit was brought in for the turkeys, which does not seem likely, or whether the turkeys picked up their own, the scarcity of material is, in all probability, responsible for the unusual variability of the samples.

Eggshells

Thirty-six samples of eggshell were recovered from the excavation of Mound 7. On the bases of texture, thickness (0.35-0.45 mm.), coloring where present, size, and contour, all of these samples but one are referred to Common Turkey (*Meleagris gallopavo*).

Two shells, which have a homogeneous residue remaining within, appear to be sterile or unincubated eggs. Seven shells contain differentiated residues of embryos in various stages of incubation.

One shell sample, although gallinaceous in texture, is finer grainier, smaller, and thinner (0.275-0.3 mm.) than the other eggs. While it may be a small egg laid by a young turkey, it is more probably that it is the egg of a Domestic Chicken (*Gallus gallus*).

Age Composition of Mound 7 Turkeys

Unworked turkey bone tabulated from Gran Quivira is assigned to a total of 923 individuals—388 males, 373 females, and 162 of unknown sex. Sexual dimorphism in the Gran Quivira turkey population is sufficient that there is no overlap apparent in the size of males and females from an estimated 5 to 7 months on. The individuals of unknown sex are either too young or too fragmentary to yield reliable data.

Criteria for grouping by age stages are based on those established by Lyndon L. Hargrave for use in identifying the Casas Grandes, Chihuahua, turkey bone. Age composition at Mound 7 did not coincide exactly with that prevailing at the Chihuahua site, so additional refinements have been made:

1. Juvenile—hatching through 5 months, 12.5%
   Small Juvenile—hatching through 1 month, 3.1%
   Medium Juvenile—2 to 3 months, 1.2%
   Large Juvenile—3 through 5 months, 8.2%
2. Immature—6 through 11 months, 16.9%. At Gran Quivira, Immatures are estimated to cluster around 6 or 7 months.
3. Young Adult—approximately 12 to 24 months, 4.4%. The few Young Adults are close to the 12-month end of the range.
4. Adult—more than 2 years old, 62.5%. This is the largest group, totaling 577 individuals, which appear to be barely 2 years old.
5. Old Adults—estimated to be at least 4 years old, 3.6%.

How long turkeys at Gran Quivira lived is unknown, but the fact that turkeys are still capable of breeding at 10 years (Schorger, 1966, p. 243) would indicate that this is a conservative estimate. Among the Old Adult specimens, the fifth caudal vertebra has completely fused with the pygostyle, and the fusion of the fourth caudal vertebra has begun.

In reviewing the age groupings (table 23), the juveniles were found in greater numbers in rooms definitely assignable to phase than was the general collection. Although this may be a factor of preservation, it is more probably connected with turkeys actually nesting in the rooms. Most of the eggshell recovered was from similar proveniences. A 12.5 percent overall mortality of poults does not seem excessive when one considers the multitude of parasites and diseases that assails young turkeys today. Actually, the percentage may have been much greater, but the porous bones decayed and were not recovered.

The 16.9 percent of the collection composed of immature turkeys is less easy to explain. Bone from this age group is liberally distributed throughout the site. One factor contributing to the death of many of this age group was metabolic malfunction, as manifested in pathologic bones. Complete skeletons of immature turkeys were recovered from interior corn storerooms of the Late Phase, which are associated with accumulations of corncobs. The carinae of the sterna, and the shafts of the tibiotarsi and tarsometatarsi, are warped in a typical rachitic manner, with some enlargement of the proximal articular head of the tarsometatarsus characteristic of perosis. Although present practices of poultry husbandry allows the birds adequate sunshine, this need was apparently not realized by the Southwestern Indians, for turkey pens are often located between the back wall of a cliff dwelling and the cliff wall, or in an unused hallway or interior room of a pueblo. Perosis results from a deficiency of manganese and an imbalance of calcium and phosphorous in the food (Jull and Winter, 1960).

The higher mortality of males both in older juveniles and in young adults may be due to the difference in growth pattern of males and females. By the time a female reaches about the seventh month, much of her growth has been accomplished. From this point on, growth slows, and by 12 months it virtually ceases. The main indication of youth among bones usually recovered from an archeological site is the opening in the interorbital septum, which is still apparent at 1 year. If an entire skeleton were encountered, further aging could be done on a basis of the fusion of caudal vertebrae with the pygostyle (cf. Eaton and Moore, 1965-66, p. 40).

In contrast to the early-maturing female, the male turkey continues to grow rapidly and for a longer period of time. In Eaton and Moore's discussion of the wild turkey (ibid., p. 36), they point out that a great deal of bone is added to the male skeleton between the sixth and tenth months, when much of their range is covered with snow. The greatest mortality of yearling wild turkeys occurs during this period, and is accompanied by a bending of the tarsometatarsus. Presumably the Indian Domestic Turkey was not entirely dependent on its own resources for food, but the added stress of this period of accelerated bone growth may well be reflected in higher male mortality.

There is relatively little pathological turkey bone other than the incidence of deficiency disease already mentioned. Most common is the fracture of the humerus or adjacent bones, such as would occur from crashing into an obstacle during panic flight. The other accidents are to the legs and feet, and could have resulted from being stepped on.

All fractures (table 24) had healed long before the death of the fowl, and apparently did not make them unfit for survival under domestication.

That 66.1 percent of the turkeys recovered from Mound 7 lived to be more than 2 years old is a strong argument for their use primarily as producers of feathers. There are no cuts on the joints to indicate dismemberment for food usage, and no burned turkey bone except that associated with cremations. Schroeder (1968, pp. 95-103) provided a concise coverage of turkey utilization in various New Mexico pueblos during the period of Spanish exploration and settlement. Apparently everyone used turkey feathers, some ate turkeys, and some who themselves did not necessarily eat turkeys had no objections to others eating them.

Surely there was some food usage of turkeys in the Late Phase, as breast, wing, or more commonly leg bones accompanied some burials. In one instance, a femur and tibiotarsus with accompanying tarsal splints represent a thigh and drumstick with meat on them. All are adults, both male and female, except for a large immature male and a young adult male.

Further suggestive of food usage is the recovery from trash of the head and foot bones of three adult turkeys that had been discarded together.

Large Indian Domestic Turkey

Considering the long span of time involved, the Gran Quivira turkey population is very homogeneous. One specimen, however, is such an unusually large male that, both by visual inspection and by statistical analysis, it simply is not part of the biological population represented at this site. The bones of this partial skeleton are larger than those of any specimen—archeological domestic, archeological wild, or modern wild—that we have been able to obtain for comparison. The only archeological turkey bones that have been studied which approach this great size are those recovered from the excavations at Tse-ta'a and at Arizona W:10:50 near Point of Pines. Although none of the measurable specimens are quite as large as the questionable one from Gran Quivira, they are of sufficient size that this large gobbler would fall well within the second standard deviation from the mean.

In addition to being of the Large Indian Domestic breed, this large individual, although not extremely old, displays pathological accretions on the ligamental attachments of the distal end of the tibiotarsus, indicating conditions of aviculture not typical of Gran Quivira. The proximal end of the tarsometatarsus shows butchering marks where the tendons had been cut to free the tarsus and foot from the carcass, another trait not typical of Gran Quivira. Perhaps this fine big bird was brought in during the Middle Phase from another area where both turkey breed and usage were different.

Cranes and Coots

The combined Sandhill Cranes yielded a minimum faunal count of 25, or 1.10 percent of the collection. Both subspecies are represented, with the Lesser which nests in Canada, predominating. Perhaps the Greater, which nests closer to New Mexico, was few in number even in late prehistoric times.

Most specimens are wing bones, but leg bones also appear, as does one partial skeleton.

Fourteen artifacts were collected, or 6.58 percent of the worked bird bone. The only elements utilized were the ulna and the long, straight tibiotarsus. Artifacts are evenly divided between the two subspecies, despite the predominance of the Lesser Sandhill Crane in the unworked bird bone collection. Like the eagle bone artifacts, the artifacts made from bones of the Greater Sandhill Crane are very large, but none overlaps the size range of the Whooping Crane. The size of these specimens is so great in comparison to the unworked bone of this subspecies that they may be trade items.

Grus canadensis: minimum faunal count—2, less than 1% of the collection

Two specimens of Sandhill Crane are of intermediate size, and are not assigned to subspecies.

Grus c. canadensis: minimum faunal count—19, less than 1% of the collection

Grus c. tabida: minimum faunal count—4, less than 1% of the collection

Fulica americana: minimum faunal count—2, less than 1% of the collection

The American Coot, with its preference for rank aquatic vegetation, would not be likely to have spent much time on the intermittent ponds near Gran Quivira. The two left humeri recovered from Mound 7 may have been brought in from an area such as the Rio Grande that had permanent water. The Mound 7 coots are dated A.D. 1300-1400. Other specimens of this species have been identified from Tuzigoot Pueblo and Swallet Cave at Montuzuma Well in Arizona, and Bg19 and Bg51 from the Largo-Gallinas District, Puaray, Gila Cliff, and Pratt Cave in New Mexico. Except for Gran Quivira, all these sites are near, if not directly on, water.

Dove, Macaws, and Roadrunners

Zenaidura macroura: minimum faunal count—3, less than 1% of the collection

Prolific and adaptable, Mourning Doves are common in the Southwest throughout the warm months, and may remain during the winter if sufficient food and shelter are available.

Ara macao: minimum faunal count—2, less than 1% of the collection

The Scarlet Macaw is the only avian species that could not have been obtained within a radius of 50 miles from Gran Quivira. A known item of trade in the Southwest from about A.D. 1 to the present (McKuisick, 1976), its nearest range is the humid, tropical lowland forests of southern Mexico (Blake, 1953, p. 192). Only one of the specimens can be assigned a date—pre-1416—thus in all probability it belongs in the Early Phase. At this time the trend for the general Southwest is a shift of macaw occurrences from north-central and east-central Arizona to the Rio Grande Valley in New Mexico (Hargrave, 1970).

Geococcyx californianus: minimum faunal count–7, less than 1% of the collection

Extremely common at all seasons, the Roadrunner is often represented in modern pueblo ceremony by its "X" track, two toes front, and two back. The seven Roadrunners from Mound 7 are represented by five tarsometatarsi, a tibiotarsus, a femur, and two ulnae. The predominance of foot bones may be connected to a preoccupation with the track, which appears on pottery found at the site.

Owls

Specimens of four species of owls were recovered from Mound 7. The Great Horned Owl and the Long-eared Owl form the greater part of the collection, with the Burrowing Owl and Short-eared Owl present in decreasing frequencies. Whereas the Great Horned Owl and Long-eared Owl (Ligon, 1961, p. 150) are available year-round, Burrowing Owls retire to their homes in prairie dog holes and are inactive during the coldest months. Short-eared Owls were present at Gran Quivira only as winter visitors, and owls, like hawks, were utilized in direct proportion to the time they were present in the area. Only the Great Horned Owl is represented in the worked bone collection.

Bubo virginianus: minimum faunal count–6, less than 1% of the collection
[Artifacts: 4 specimens, 1.88% of the worked bird bone

Elements used for tubes are two ulnae and a femur. An ungual that had been cut from the toe displays wear-facets on the articular surface, suggesting use as an ornament.

Great Horned Owls are represented in the unworked bone collection only by wing and leg bones, and may have been valued mainly for their feathers and claws. This species occurs in many Southwestern sites.

Speotyto cunicularia: minimum faunal count–4, less than 1% of the collection

The Burrowing Owl has been recovered from Wupatki, Nalakihu, and Point of Pines in Arizona; Casas Grandes in Chihuahua; and Las Madres, Pueblo Largo, Pindi Pueblo, and Pottery Mound in New Mexico. Specimens from Mound 7 include a cranium, coracoid, scapula, femur, and tibiotarsus.

Asio otus: minimum faunal count–6, less than 1% of the collection

With the exception of a fragmentary pelvis, all bones identified to the Long-eared Owl are from the wings and legs. Other occurrences are at Swallet Cave (at Montezuma Well), Nalakihu, and Houck B in Arizona; and at Bc51 in Chaco Canyon, Bg19 in the Largo-Gallinas District, Pueblo Largo, and Pratt Cave in New Mexico.

Asio flammeus: minimum faunal count–1, less than 1% of the collection

The Short-eared Owl is represented at Gran Quivira by a ingle carpometacarpus. It is also present in archeological collections from Long House in Colorado and Nalakihu in Arizona.

Nighthawk
Chordeiles minor: minimum faunal count–1, less than 1% of the collection

A right ulna is the only element representing the Common Nighthawk. This species has also been identified from Rainbow House and Pueblo Largo, New Mexico.

Passerines
Eremophila alpestris: minimum faunal count–12, less than 1% of the collection

Eleven specimens of the Horned Lark are represented by the head and/or axial skeleton; the twelfth is represented by the wing and leg bones. Whatever their use, it seems to have consistently involved the separation of wing and leg bones from those of the body (cf. discussion, "Special Usages"). The Horned Lark has been identified from Bc236 and Talus Unit in Chaco Canyon, and from Pueblo Largo, Las Madres, and Pueblo Pardo in central New Mexico.

Progne subis: minimum faunal count–1, less than 1% of the collection

The Purple Martin is represented at Mound 7 by a sternum. Although this species could have been taken at Las Humanas, it, like the Goshawk, would have been more likely on timbered mountains nearby. That there are only two high-mountain species represented by one specimen each does not suggest a very intensive usage of this zone by the inhabitants of Las Humanas, and many indicate that both the Goshawk and the Purple Martin were trade items.

Corvidae

As with hawks and owls, the black corvids were used in proportion to the time they were present in the area surrounding Las Humanas. Common Ravens, which are resident all year, are most prevalent; crows, which are present only during the winter, are much less common; and the White-necked Ravens, which do not now range as far north as Gran Quivira, are least common of all. That all three species were used in the same way is indicated by the occurrence together of three left ulnae, one from each species. Corvids are commonly recovered from southwestern sites.

Corvus corax: minimum faunal count–78, 3.43% of the collection
[Artifacts: 3 specimens, 1.41% of the worked bird bone

Elements of the common raven utilized for artifacts are an ulna and two femora. Unworked bone included 35 wing bones, 18 leg bones, 15 nearly complete skeletons, six crania, and four samples from the axial skeleton. No pygostyles were found in any of the samples, which, with the prevalence of wing elements, suggests a major feather use. (Nearly complete skeletons and crania are discussed in the section on "Special Usages.") Stephen mentioned the Hopi custom of impaling a raven on the point of a lance "to feed on the enemies to be slain" (Parsons, 1936a, p. 95), which may antedate the Navajo use of ravens in Enemy Way.

Corvus cryptoleucus: minimum faunal count–2, less than 1% of the collection

White-necked Ravens are now found only in the southern part of New Mexico. F. M. Bailey (1928, p. 490) connected their disappearance from their former, more northern range with the extermination of the buffalo. In 1870, they ranged along the western margin of the plains up to northern Colorado; but by 1880, they were found only as far north as the Galisteo Basin. Other sites where they have been identified, which lie north of their present range, are two in the Point of Pines area of Arizona, covering a time span of about A.D. 1100-1450, and three in New Mexico (Los Aguajes, Las Madres, and Pueblo Largo), which are a little earlier than, or contemporaneous with, the occupation of Mound 7.

Both White-necked Raven specimens are left ulnae.

Corvus brachyrhynchos: minimum faunal count–2, less than 1% of the collection

Crows are represented by the bones of wings, legs, and beaks. Both ulnae of one individual display butchering marks made in severing the tendons that join the wing feather fan to the upper wing.

Gymnorhinus cyanocephalus: minimum faunal count–3, less than 1% of the collection

The Pinyon Jay is the only blue-plumaged bird recovered from Mound 7. Two individuals were found together in trash fill. One is represented by major elements except the head, the other by a humerus. Other specimens of this jay have been identified from Mesa Verde, Chaco Canyon, Glen Canyon, Las Madres Pueblo, and Pratt Cave in southern New Mexico.

Other Perching Birds

Catherpes mexicanus: minimum faunal count–1, less than 1% of the collection

The Canyon Wren is represented by a fragmentary cranium and an intact tibiotarsus.

Sturnella sp.: minimum faunal count–1, less than 1% of the collection

A meadowlark of unknown species is represented by an intact tibiotarsus.

Carpodacus mexicanus: minimum faunal count–1, less than 1% of the collection

The House Finch is represented by a right humerus.

Fringillidae sp.: minimum faunal count–1, less than 1% of the collection

The mandible of an unknown large sparrow was recovered from trash fill. Refuse areas are often a better source of faunal remains occurring in low frequencies, while more abundant forms, such as the ravens from Mound 7, are recovered from room floors.

Few passerines other than the large corvids have been identified from archeological sites because of their small size. Passerines identified here are referred to species. One specimen is so fragmentary that it can be assigned only to the general category of sparrows and finches.

House A Birds

The Late Phase room block known as House A lies on the southwestern edge of the pueblo, adjacent to the site of the *convento* and mission church of San Buenaventura. It was one of the three structures excavated by Gordon Vivian between March and May, 1951. The mammalian remains, identified by John F. Turney, and two bird bones, identified by Lyndon L. Hargrave, were reported in *Excavations in a 17th Century Jumano Pueblo, Gran Quivira,* (Vivian, 1964, pp. iv, 36, 137). The two bird bone specimens are included in the totals and tables to give a complete picture of avian remains. None of the bird bone examined was worked, nor was any concentration of bone observable in the rooms or plaza excavated.

Avian Faunal List

Latin Name	Common Name	Unworked	Worked	MFC	Percentage
Cathartes aura	Turkey Vulture	x		1	3.85
Buteo jamaicensis	Red-tailed Hawk	x		6	23.05
Buteo swainsoni	Swainson's Hawk	x		1	3.85
Buteo regalis	Ferruginous Hawk	x		4	15.40
Aquila chrysaetos	Golden Eagle	x		2	7.70
Falco mexicanus	Prairie Falcon	x		1	3.85
Meleagris gallopavo	Small Indian Domestic Turkey	x		9	34.60
Grus canadensis canadensis	Lesser Sandhill Crane	x		1	3.85

Avifauna of San Buenaventura Mission

> "He said that. . .the feast of San Buenaventura has been celebrated for many years in the pueblo of Humanos; for Fray Francisco de Acevedo, who has administered those pueblos thirty years or more, has always kept the feast of Señor San Buenaventura, always taking Indians from the chapel of the pueblos of Abó, Humanos, and Tavira for the purpose" (Nicolás de Aguilar, 1664, in Hackett, 1937, p. 144).

During the ruins stabilization program carried out in 1962 on the church and *convento* of San Buenaventura de las Humanas, Roland S. Richert and Charles Voll collected a sample of faunal remains. The specimens resulted mainly from excavations along walls to determine the stability of foundations, and from dry wells constructed to accommodate water drained from stabilized rooms. During July of 1969 the bird bone from this collection was examined and identified to obtain a better understanding of the use of these species during the mission period.

One hundred and forty-two specimens yielded 15 identifications, 13 of them carried to species level. *Meleagris gallopavo* and the Falconiformes make up the bulk of the collection with a value of 94 percent, which closely follows the pattern found at Mound 7. The Small Indian Domestic Turkey has the highest minimum faunal count of all species.

Avian Faunal List

Latin Name	Common Name	Unworked	Worked	MFC	Percentage
Buteo sp.	Buteonine Hawk	x	x	9	6.34
Buteo jamaicensis	Red-tailed Hawk	x	x	22	15.49
Buteo swainsoni	Swainson's Hawk	x		6	4.23
Buteo lagopus	Rough-legged Hawk	x		3	2.11
Buteo regalis	Ferruginous Hawk	x	x	23	16.20

Aquila chrysaetos	Golden Eagle	x	x	15	10.56
Falso mexicanus	Prairie Falcon	x		7	4.93
Gallus gallus	Domestic Chicken	x		1	.70
Meleagris gallopavo	Small Indian Domestic Turkey	x	x	54	35.93
Bubo virginianus	Great Horned Owl	x		1	.70
Corvus corax	Common Raven	x		2	1.41
Corvus brachyrhynchos	Common Crow	x		1	.70
Turdidae sp.	Thrush	x		1	.70

Butchering Technique

Eight specimens in the collection serve to demonstrate butchering technique. Five similar specimens noted in the Late Phase sample from Mound 7 are also considered here. The distal ends of the femora were cut at an oblique antero-dorsal angle, removing the ridges of both the lateral and medial condyles in the process. By cutting into the femoral-tibiotarsal joint in this manner, the tendons and fasciae would be easily severed, and the patella turned down. With the upper and lower parts of the leg tightly flexed, the remaining ligaments holding the leg together would then be cut. Removal of the lower leg at this point may be related to tube manufacture, since artifacts worked from this element appear in the Mound 7 collection.

Three humeri belong to the individuals discussed above also show cuts made by a sharp instrument. In each case the deltoid crest was cut longitudinally, and the shafts were broken about midway. If the objective was to remove a feathered wing from the carcass, it would have been desirable to cut as close to the body as possible to include the axillaries. It is less difficult to break the shaft of the humerus about midway than to cut into the glenoid area among the complicated mass of coracoid and scapular heads bound in their associated ligaments. Cutting along the lateral surface of the shoulder would sever the tendons and expose the humerus, which is easily broken, and the wing could be removed. Specimens of both leg and wing bones have discolored regions near the cuts, as well as breaks characteristic of bones removed while fresh. The cuts were made by a sharp-edged tool. All specimens are from Late Phase proveniences—after the introduction of metal tools. The bone was cut with a single stroke of an implement as effective as a metal cleaver, and not with a stone implement. Today, using sharp steel tools, it takes considerable effort to cut through fresh bone. In the pre-Spanish method of disjointing birds, crushing accompanied cutting in removing wings and legs from larger birds. The modern method of removal is to pull the wing up, exposing the axillary region, and, at the same time, drawing the humeral head out of the socket; the joint is then severed from below.

Worked Bird Bone

Four species are represented by eight specimens of worked bone from this sample: three are of the subfamily Buteoninae, and one is a turkey. Five of the specimens were worked into tubes from appendicular long bones, and three were cut-off ends of long bones, which represent the waste products of tube manufacture.

Two 3½-inch tubes were made from the right ulna of a large Ferruginous Hawk of female size range by transverse cuts near both articular ends, followed by cuts through the middle of the shaft. The tabular surface shows that some smoothing was done, leaving longitudinal abrasion marks, but the ends are still rough, indicating the tubes were unfinished.

The third tube is also from the right ulna of a large, female Ferruginous Hawk. The proximal articular head was removed by cutting transversely, but the distal end of the tube is broken. The tabular surface shows transverse abrasions, with the brachialis anticus depressions especially smoothed.

A shaft fragment of a small male Golden Eagle humerus displays longitudinal grinding of the tabular surface. However, the bone is too fragmentary to determine its use.

A fragmentary tube 1¼ inches long was made by transversely cutting the left humerus of a large male turkey. The tabular surface was then ground in a transverse direction.

Three examples of tool stock include a right humerus of a Ferruginous Hawk cut transversely from the shaft just below the deltoid crest, the proximal articular head of the ulna of a Red-tailed Hawk removed by transverse cuts, and the right humerus of a Golden Eagle incised transversely near the distal articular end. The ends of the two humeri were removed while the bone was still fresh.

Notes on the Collection

All the species identified in the collection from San Buenaventura have been described in the Mound 7 section, except for one species belonging to the family Turdidae.

Turdidae sp.: minimum faunal count—1, less than 1% of the collection

The thrush family is represented by a single specimen, a right ulna. At present the element can only be identified to family level. However, it compares closely with *Hylocichla guttata* (the Hermit Thrush)—a similarity that fits well ecologically for the Gran Quivira region. In summer, the Hermit Thrush is found in the higher, well-watered forested areas, while during migration, it may be seen in lower country wherever there is shrub or tree cover. The Hermit Thrush nests at an elevation of about 6,800 feet (Ligon, 1961, p. 231). The other member of the thrush family that overlaps its size range is Swainson's Thrush, which has been recorded only as a summer resident of the northern part of the state.

Pueblo Pardo Birds

Pueblo Pardo, located on a limestone outcropping 1½ miles south of Gran Quivira National Monument and about 2½ miles from Mound 7, was partially excavated in 1941 by a field party from Washington and Jefferson College under the direction of Joseph H. Toulouse, Jr. and Robert L. Stephenson (1960). The 14 rooms and one kiva uncovered are considered to be a contemporaneous with the Middle and Late Phases of Gran Quivira.

The bird remains from this site, originally identified by Dr. Pierce Brodkorb (ibid., 1960, p. 38), have been reexamined, and another species recorded from examination of an additional collection of unidentified bird bone.

Minimum faunal counts have been calculated from the entire collection. Identification of the previously reported *Anas* species has been carried to the specific level, *Anas carolinensis.* Identification to specific level of the *Aythya* species, however, was less successful.

Avian Faunal List

Latin Name	Common Name	Unworked	Worked	MFC	Percentage
Branta canadensis	Canada Goose	x		3	4.47
Anas carolinensis	Green-winged Teal	x		1	1.49
Aythya sp.	Diving Duck	x		1	1.49
Buteo jamaicensis	Red-tailed Hawk	x		5	7.45
Buteo swainsoni	Swainson's Hawk	x		4	5.96
Buteo regalis	Ferruginous Hawk	x		10	14.95
Aquila chrysaetos	Golden Eagle	x		7	10.44
Falco mexicanus	Prairie Falcon	x		1	1.49
Falco sparvarius	Sparrow Hawk	x		2	2.98
Callipepla squamata	Scaled Quail	x		1	1.49
Meleagris gallopavo	Small Indian Domestic Turkey	x		25	37.34
Numenius americanus	Long-billed Curlew	x		1	1.49
Speotyto cunicularia	Burrowing Owl	x		2	2.98
Eremophila alpestris	Horned Lark	x		1	1.49
Corvus corax	Common Raven	x		3	4.47

Notes on the Collection

Percentage composition for species from Pueblo Pardo is about the same as for the samples from House A and San Buenaventura, except for the three Canada Geese and two ducks. One species identified at Pueblo Pardo (*Numenius americanus*) was not found in the other three sites.

Numenius americanus: minimum faunal count–1, 1.49% of the collection

The Long-billed Curlew, a shore bird, is common on the high plains of eastern New Mexico and in the Pecos Valley, where there is moisture and vegetation. Nesting has been recorded near Vaughn, New Mexico, but none further west. The individual from Pueblo Pardo was probably a fall migrant, since the range in that season is at least to 7,000 feet (F. M. Bailey, 1928, p. 259). The wings of these birds, with dark and light bars, are similar to those of members of the hawk families. The bird may have been taken for its feathers, or for its long decurved bill. This species has also been recovered from the excavations at Casas Grandes, Chihuahua.

Summary of Avian Remains

Single specimens of three bird species were identified from Mound 7 of Gran Quivira that are not recorded at the Southwest Archeological Center as having previously been identified from archeological sites: *Progne subis* (Purple Martin), *Catherpes mexicanus* (Canyon Wren), and *Carpodacus mexicanus* (House Finch). They may have been accidental occurrences.

If the species list is considered from the viewpoint of feather usage–based on the occurrence of bone elements, the butchering marks on them, and modern ethnographic parallels–the distribution shown in Table 25 results.

The remaining birds are mostly waterfowl and marsh birds. Duck feathers have been used by prehistoric Indians, but they do not fall into a definite color class (Lipe, 1960, fig. 2).

Fifty-one species have been identified from Mound 7, House A, the church and *convento* of San Buenaventura de las Humanas, and Pueblo Pardo. Of these, only 20 species are included in a check list of birds prepared in August, 1956, for Gran Quivira National Monument. Two domestic fowl, the Small Indian Turkey and the chicken, and a Mexican import, the Scarlet Macaw, were brought in as living birds by the inhabitants. Two others, the Purple Martin and the Goshawk, are mountain forms. Eighteen species that prefer a water habitat are plentiful in the Rio Grande Valley. The White-necked Raven and the Mearns Quail are indicative of former more extensive ranges; in the case of the raven, the present reduction of its range is closely linked to the activities of man, and the same may be true in the case of the quail. Four hawks and two owls which do not appear on the checklist should still be in the general area, although their number has been reduced by shooting and by the extermination of the prairie dog. All Mound 7 species except domestic fowl and macaws are available within a 45-mile radius of the site.

Mound 7 avifauna reflect some change of activity during the Middle Phase. "Fetishes" (as described under "Special Usages") are not found after this period. The unworked bird bone collection indicates a definite high in Swainson's Hawk, the Sparrow Hawk, the Scaled Quail, and turkeys during the Middle Phase, with a low for ravens. In bone artifacts, the buteonine hawks reach their high in the Middle Phase, at the same time Golden Eagles reach their low.

Three families–hawks (including eagles), falcons, and turkeys–account for 90.58 percent of the collection from Mound 7, while waterfowl, cranes, and corvids comprise an additional 6.42 percent. The remaining 3 percent is distributed among 15 families.

Mammal Remains, Mound 7

> "When the Indians have a general hunt, it is a very interesting sight to see. Four or five thousand of them get together and go along scaring out the animals from all the hills they have chosen, and they keep on encircling them in such a manner that at whatever point the animals try to escape they run into some of the men; and these keep closing the circle so that in a short time they have all of the game–animals of every kind-rounded up. Then those who are to do the killing enter the circle, and those on the outside draw closer. Whatever is killed is divided among all, although special consideration is shown the captains" (Fray Alonso de Benavides, in Forrestal, 1954).

Approximately one-sixth of the Mound 7 mammal bone collection has been examined, totaling 11,676 specimens. Eleven percent of the total examined, or 1,370 specimens, were discarded as lacking the characters necessary for identification. All unidentified specimens in this category are considered to be fragments of individuals included in the minimum faunal count. Specimens belonging to other individuals are totaled under such taxa as Carnivora or Mammalia.

Proveniences sampled are of all types, and cover the time span for the occupation of Mound 7. All burials were examined to obtain samples of small rodents from the fine screening employed to recover such small burial artifacts as beads. Some extramural samples of refuse have been particularly productive of mammals occurring in very low frequencies.

Mammalian Faunal List

In some instances where archeological mammal bone samples compare favorably in size and proportion with the race inhabiting the area today, subspecific designations have been assigned. Suggested subspecies are assigned on a basis of modern distribution.

Latin Name	Common Name	Unworked	Worked
Mammalia sp.	Unknown mammal	x	x
Homo sapiens	Man	*	x
Sylvilagus auduboni cf. *cedrophilus*	Desert Cottontail	x	x
Lepus californicus cf. *texianus*	Black-tailed Jackrabbit	x	x
Rodentia sp.	Unknown rodent	x	
Citellus variegatus cf. *grammurus*	Rock Squirrel	x	
Cynomys ludovicianus cf. *arizonensis*	Black-tailed Prairie Dog	x	
Geomyidae sp	Pocket Gophers	x	
Thomomys sp.		x	
Geomys sp., cf. *G. bursarius* and *G. arenarius*		x	
Perognathus flavus, cf. *flavus*	Pocket Mouse	x	
Dipodomys sp., cf. *ordii*	Kangaroo Rat	x	
Dipodomys spectabilis baileyi	Banner-tailed Kangaroo Rat	x	
Peromyscus sp.	New World White-footed and Deer Mice	x	
Neotoma sp., cf. *N. a. albigula* and *N. micropus canescens*	Wood Rat	x	
Erethizon dorsatum cousei	Porcupine	x	
Carnivora sp.	Unknown carnivore		x
Canis sp.	Wolf or dog	x	x
Canis lupus nubilus	Gray Wolf	x	x
Canis familiaris	Dog	x	x
Canis latrans, cf. *texensis*	Coyote	x	x
Vulpes macrotis neomexicana	Kit Fox	x	x
Ursus sp.	Grizzly or Black Bear	x	x
Ursus americanus amblyceps	Black Bear	x	x
Procyon lotor	Raccoon	x	
Taxidea taxus, cf. *berlandieri*	Badger	x	
Spilogale gracilis, cf. *gracilis*	Western Spotted Skunk	x	
Felidae sp.	Lynx or Bobcat-sized Felid	x	
Felis domesticus	Domestic Cat	x	
Felis concolor	Mountain Lion		x
Lynx rufus	Bobcat	x	x
Equus sp.	Horse, ass, or mule	x	
Equus caballus	Domestic Horse	x	x
Artiodactyla sp.	Medium-sized artiodactyl	x	x
Sus scrofa	Domestic Swine	x	
Cervidae sp.	Elk or Deer		x
Odocoileus sp.	Deer	x	x
Odocoileus h., cf. *hemionus*	Mule Deer	x	x
Odocoileus virginianus texanus	White-tailed Deer	x	x
Antilocapra a. americana	Pronghorn	x	x
Bovinae sp.	Domestic Cattle or American Bison	x	x
Bos taurus	Domestic Cattle	x	
Bison bison	American Bison	x	x
Capra sp.	Domestic Goat	x	
Ovis canadensis mexicana	Mountain Sheep	x	
Ovis aries	Domestic Sheep	x	

*Unworked human bone is treated separately (Reed, Part 7).

Nature of the Specimens

The bulk of the Mound 7 mammal collection consists of fragments about 3 inches long of the appendicular long bones of artiodactyls. Although most have been gnawed by carnivores and rodents, small transverse cuts from skinning, removal of the legs from the carcass, or removal of meat are apparent. There is no evidence of the use of cleavers or other heavy chopping tools until the Late Phase. Except for an Early Phase sample, artiodactyl long bones have been shattered, probably by a hammerstone, perhaps both to remove the marrow and to make them small enough to fit into the cooking pot. Whole carcasses of pronghorn, hares, rabbits, and other small mammals were carried to the pueblo. Usually, however, only the fore and hind legs, antlers, and brain cases with facial parts removed were carried home in the case of deer. Bison is represented in the unworked bone by little other than the ribs.

Butchering Methods

Deer, of which only certain parts were usually brought home, give the best clues to butchering techniques. The foreleg was removed from the carcass by separating the scapula from the ribs, and the scapula was then easily severed from the humeral head by cutting from the medial side. Not so easy, however, was the removal of the lower leg, during which the proximal articular head of the ulna was quite often damaged. The femora were apparently cut from the acetabula without much difficulty. The easy way to disjoint the hind legs from the pelvis is to cut the muscle along the back on each side of the midline, which leaves very little meat on the pelvis and allows easy access to the joint. Some deer apparently were transported with the hind legs still attached to the pelvis. So far as can be determined, no attempt was ever made to split the carcass. In deer, antelope, and bison, the ribs were broken off below the vertebral heads. The Navajo continue this practice today, stewing the back bone with attached rib heads so that they may be pulled apart with the fingers and the morsels of meat eaten from the bones (Vivian Dodge, personal communication). The reason the axial skeleton of deer was so seldom brought home may have been due to difficulties of transportation or preservation. Flies frequently attack and spoil the meat attached to the vertebral column, perhaps because the interior of the carcass is more often moist, providing ease of entry. Then again, the rib cage and vertebral column are disproportionately heavy and unwieldy for the meat they carry. It would be more practical to utilize these parts for camp meat, and to carry away the more compact cuts.

From all indications, antelope were disjointed in the same manner as deer. The axial as well as the appendicular skeleton was broken in small pieces. There are no marks such as a cleaver would leave, but long bones were broken in the same manner as fresh modern bones, which are struck every 2 or 3 inches with a hammer.

One problem these people seem to have experienced in butchering was removing the head from the cervical vertebrae. They first cut the meat and tendons all the way around the spinal column, and then apparently twisted the head to disjoint it from the neck, often breaking the first cervical vertebra in the process. Using these techniques, it should have been possible for one person to skin and dismember an antelope in about a half-hour.

For those accustomed to the work, bison posed no great butchering problem. According to Pedro de Casteñeda's narrative of 1540-1542, bison were opened from the back with a finger-sized flint fastened to a small stick. This method requires the help of several people to roll the kill from its side onto its haunches, but from then on butchering can be continued by one or two persons. The skin is slit down the back and spread on the ground on each side to provide a clean working surface. Meat is removed from the hump down to the limbs, leaving the abdominal cavity untouched until almost the last. In addition to meat and fat, Casteñeda reported that the buffalo hunters drank not only the blood, which they conserved in a cleaned large intestine, but also the juice, which they squeezed from the masticated grass in the stomach (Hammond and Rey, 1940, p. 262).

Although we have no historical record of the use of internal organs of deer and antelope that the fastidious would now discard, it is probable that they were utilized in a manner similar to bison. Meat and much of the viscera were surely eaten; hides, tallow, and sinew saved; and horns, antlers, and certain bones made into tools. In the Early Phase sample from Mound 7, the brain cases of deer and pronghorn occur with horns or antlers and facial parts removed. Perhaps the brain was stored in its own bony container until needed for tanning or some other purpose. In younger deer, the cranial cavity was opened by punching out the small, round interparietal bone. In older deer, in which this bone is fused, and in pronghorn, the same circular area was pecked out with a pointed tool. By the Late Phase, pronghorn crania were brought in with facial parts intact, opened, and then discarded. Deer skulls of this period had the antlers removed, and then the left posterior portion of the brain case was severed as with a right-handed blow from a cleaver.

Food Production

The minimum faunal count has been recorded for each phase so that the quantity of meat produced from the utilization of each species could be determined. With the exception of the White-tailed Deer and the introduced domestic animals, values for these computations are taken from "A Method of Calculating the Dietary Percentage of Various Food Animals Utilized by Aboriginal Peoples" (T. E. White, 1953). The value given for Whitetails is for a larger subspecies than occurred in the Mound 7 collection, so it was reduced accordingly. Values for domestic animals are calculated from modern breeds of size and proportion similar to those present in the archeological collection. Since the Indians used more of the viscera than is customary today, food produced is expressed as a percentage of the whole rather than as pounds (see table 26).

Hares and rabbits, which aggregate about 30 percent of the minimum faunal count in each period, are included in Table 27 under "All Others," along with prairie dogs, wood rats, and gophers. One male bison can provide as much meat as 18 pronghorn or 300 jackrabbits. Bison, therefore, in spite of the low faunal count, could have provided more usable meat than any other single species in every period. Pronghorn is second to bison in each phase, followed by Mule and White-tailed Deer. In the Late Phase, the introduced domestic animals, primarily Domestic Cattle, could have provided a greater quantity of meat than any native animal hunted. There are, however, other considerations.

The animals listed in Tables 26 and 27 only represent the ones processed at Las Humanas. Dried meat could have been traded in from the plains in unknown quantities; too, some meat and tallow processed at the pueblo could have been traded out, particularly under the *encomienda* system. It may be that the meat, tallow, and hides of the artiodactyls were primarily items of commerce rather than products for local consumption, and that their corn-based diet was more often varied with marrow bones, hares, rabbits, woodrats, gophers, and prairie dogs. There is no evidence that turkeys were used for meat much before the end of the Late Phase.

Worked Mammal Bone

Of the 784 bone artifacts from Mound 7, 4 specimens (less than 1 percent of the collection) have been referred to "Bird or Mammal, Unknown." This is a factor of the high degree of alteration of the artifact. In the case of tubes, particularly, polishing has been carried to such an extreme that diagnostic characters are absent.

Mammal specimens outnumber birds in the Mound 7 artifacts in a ratio of 72.58 percent for mammals to 26.91 percent for birds. Mammals also predominate in the number of identification categories, with a total of 23 for mammals and 14 for birds. Artiodactyls occur most frequently as a source of heavy utilitarian artifacts, while carnivores provided stock for most of the mammal bone tubes.

All carnivores combined account for 9.14 percent of the mammal artifacts. Carnivores comprise 4 percent of the collection in the Early Phase, 9.99 percent in the Middle Phase, and 14.28 percent in the Late Phase. This increase reflects an increase in bone tube specimens which parallels that observed in bird bone artifacts. The assignment of 10 designations—an order, a family, a genus, and seven species—indicates a wider than usual utilization of carnivore material.

An examination of the percentage lists for worked and unworked bone reveals a positive selection in carnivores (particularly coyote and bobcat), as well as in artiodactyls (especially Mule Deer and bison). Percentages of hare, rabbit, and White-tail Deer artifacts are lower than for unworked bone (table 28).

Leather

During the hearing of Nicolás de Aguilar in 1661, Las Humanas was described as the most populous pueblo of the area, to which all sorts of people came to trade corn and antelope skins. So brisk was business that in order to avoid bloodshed, the people of Quarai were restrained by the Spanish from visiting the pueblo while Apaches were present (Hackett, 1937, pp. 135 and 143).

Six samples of leather or hide were recovered from the excavation of Mound 7. Two are very thin, perhaps from some small mammal such as a rabbit. Two others are of sufficient thickness that they could have come from a medium-sized artiodactyl. The last two, which are as thick as the leather used for shoe soles, may have been made from bison, cow, or horse hide.

Five of the specimens were recovered from Late Phase proveniences. One specimen of medium thickness was found with a Middle to Late Phase infant, Burial 107. The largest specimen, a very thin rag of leather, was found in a pot in Room 13 with an assortment of other objects; it may originally have been part of a pouch. All other specimens are too fragmentary to give any clue to their original use.

Subspecific and Size Variation

Las Humanas lies on the border of two major biotic units. Here, grasslands change rather abruptly to pinyon-juniper woodland without an intervening band of brush. The grassland, characterized by populations of bison, pronghorn, jackrabbit, kangaroo rat, pocket gopher, Kit Fox, and Badger (Shelford, 1963, p. 232), provided the major source of supply for meat, hides, tallow, sinew, and bone for heavy-duty tools. Pinyon-juniper woodlands, inhabited by Mule Deer, Mountain Lions, Bobcats, porcupines, Gray Foxes, Rock Squirrels, and wood rats (ibid., pp. 287-289), were utilized less intensively.

Aside from considerations of faunal resources available to the inhabitants of Las Humanas, some species are represented in central New Mexico by an interdigitation of the subspecies present in the Plains and in the Southwest. For example, Mule and White-tailed Deer, pronghorn, bison, and Gray Wolf remains from Mound 7 have been assigned to subspecies commonly inhabiting the plains. On the other hand, porcupines, Kit Foxes, coyotes, and Raccoons have been assigned to subspecies typical of the Southwest, and in some cases perhaps more accurately considered as northern extensions of Mexican forms (Hall and Kelson, 1959, vol. II).

The osteological differences in general size and rugosity of the Gran Quivira material in contrast to the modern comparative collections at the Southwest Archeological Center are marked. The majority of elements from the Mound 7 site, consisting of long bones in particular, are larger both in length and in width. Those specimens that do not match the elements of the comparative skeletal material in length nevertheless generally measure thicker in diameter. In working through the Mound 7 sample collection, we seldom encountered an instance in which these elements were not larger in one manner or another. The Gran Quivira collections show that the mammals occurring in that region before the 1700's tended to be larger than present-day forms as they are represented in the Southwest Archeological Center comparative collection. It should be noted, however, that the specimens in the comparative collection were taken from various parts of the Southwest, and may not be representative.

The size observation holds true for nearly all the mammalian genera identified from excavations at Gran Quivira, ranging from rabbits and hares through the native artiodactyls. A factor that might contribute to the heavier bone structure of these mammals is the kind of soils that produced their food supply. The inorganic portion of mammal bone is composed of about 85 percent calcium phosphate, an adequate source of which is therefore necessary for bone development (Sisson, 1958, p. 24; Walter and Sayles, 1949, p. 147). Since there is an overabundant supply of calcium from limestone in the topsoils of that region, perhaps it is responsible for the sturdy bone structure observed in these animals. Certainly it is known that a deficiency of calcium, whether because of dietary lack of the mineral itself or because of an insufficient supply of Vitamin D necessary for absorption, will result in rickets. Some modern trophy hunters are attracted to limestone country (the northern Kaibab Forest of Arizona, for example) convinced that it supports the biggest deer with the most massive racks (C. A. Thomas, personal communication, 1969; cf. Stapleton, 1969, pp. 12-18).

Another causal factor for the large size of the pre-1700 mammals could be differences in climatic conditions extending over a prolonged period that varied from those under which modern specimens were produced.

Size discrepancies in skeletal remains of bird life at Gran Quivira are less evident. Many of the species utilized are migratory, spending only a portion of their year in New Mexico. However, there is a noticeable difference in the average thickness of eggshells found at the Mound 7 site and those of today's turkeys. Phillips and Williams (1944) measured modern shell thicknesses ranging from 0.28 to 0.41 mm., with an average thickness of 0.35 mm. That part of the eggshell collection from Mound 7 referred to Domestic Turkeys ranged in thickness from 0.35 to 0.45 mm., with an average thickness of 0.38 mm. The major component of eggshell is calcium carbonate, the same mineral that constitutes limestone.

Notes on the Collection

Subspecific designations have been assigned only when bone samples compared favorably with modern comparative specimens of the subspecies present in the area today. Suggested supspecies are based solely on modern distribution.

The age designations used are "immature" (epiphyses unfused), "young adult" (line of epiphyseal fusion still visible), "adult" (epiphyseal line no longer visible, and "old adult" (bones bearing accretions and overgrowths characteristic of advanced age).

Mammalia sp.: minimum faunal count–5, less than 1% of the collection

[Artifacts: 20 specimens, 3.73% of worked mammal bone

One artifact is made from a scapular spine, one from an unknown tabular surface, and the other 18 are shaft fragments of appendicular long bones. All individuals are fully adult. These specimens are referred to Mammalia sp. because their surfaces are altered to such an extent that no identifiable characters remain.

Unknown mammal in refuse bone consists entirely of specimens so immature that they cannot be reliably identified.

Homo sapiens: unworked human is treated in Part 7

[Artifacts: 1 specimen, less than 1% of worked mammal bone

A disc cut from the cranium (right parietal) of an adult has been perforated by two holes as for a button. The use of human bone for artifacts is infrequent in the Southwest north of

Mexico, but a similar and possibly contemporaneous specimen was found at Pecos (Kidder, 1932, fig. 199).

Sylvilagus auduboni, cf. *cedrophilus* (Hall and Kelson, 1959, pp. 259-267): minimum faunal count–216, 13.84% of the collection

[Artifacts: 1 specimen, less than 1% of worked mammal bone

A tube has been worked from the distal shaft of the right humerus of a medium-sized adult Desert Cottontail. The delicate bones of rabbits, although readily available, occur in low frequencies in collections of mammal bone artifacts in Southwestern sites. Rabbit bone artifacts have been identified from Long House and Mug House, Wetherill Mesa, Colorado; and from Kin Kletso in Chaco Canyon, Aztec Ruin, Pueblo Largo, and Las Madres Pueblo, New Mexico.

Lepus californicus, cf. *texianus* (Hall and Kelson, 1959, pp. 273-274, 282-283): minimum faunal count–284, 19.19% of the collection

[Artifacts: 29 specimens, 5.09% of worked mammal bone

The only concentration of jackrabbit bone tools evident for the site is the occurrence of nine artifacts, previously unknown from the literature or other areas of Mound 7, that were recovered from a small sample of Kiva M, Stratum B. The remainder of Stratum B and other strata of this kiva have not been examined, so it is possible that other specimens of this type may be identified. This tool appears to be a flesher of some sort, perhaps used to dress hides, in which the wear occurs along the iliac crest of either right or left innominate. Other elements utilized for tools are seven tibiae, six metatarsals, two each humeri, radii, humeri, and a scapula. Immature, young adult, and adult individuals are represented. Jackrabbit bone artifacts have been found at all the sites noted above for rabbits except Long House.

Although Leporidae are well represented in the unworked sample, 500 individuals totaling 32.03 percent of the minimum faunal count, they accounted for only 5.27 percent of the mammal bone artifacts, and the meat they provided was much less than that secured from deer, pronghorn, or bison.

Rodentia sp.: minimum faunal count–2, less than 1% of the collection

Two specimens of rodent bone were so fragmentary that they could not be assigned even to family.

Citellus variegatus, cf. *grammurus* (Hall and Kelson, 1959, p. 353): minimum faunal count–10, less than 1% of the collection

Cynomys ludovicianus, cf. *arizonensis* (Hall and Kelson, 1959, pp. 365-368): minimum faunal count–29, 5.09% of the collection

All prairie dog bones recovered from Mound 7 are as large as or larger than modern comparative specimens of the Black-tailed Prairie Dog. Burrowing Owls (*Speotyto cunicularia*) were also recovered from the excavation of Mound 7 and may well have been collected along with the prairie dogs whose burrows they often occupy.

Geomyidae sp.: minimum faunal count–1, less than 1% of the collection

A single fragmentary specimen of long bone could be identified only as pocket gopher.

Thomomys sp.: minimum faunal count–3, less than 1% of the collection

The species of *Thomomys* represented in New Mexico are the Southern Pocket Gopher (*T. umbrinus*) and Bailey's Pocket Gopher (*T. baileyi*). Since the two species are closely allied in structure, some authorities regard them as the same (Hall and Kelson, 1959, pp. 412-415 and 435; cf. Zoogeography, xxiii-xxx).

Geomys, cf. *bursarius major* (Hall and Kelson, 1959, pp. 450 and 451; Merriam, 1895): minimum faunal count–6, less than 1% of the collection

Geomys, cf. *arenarius brevirostris*: minimum faunal count–3, less than 1% of the collection

Gran Quivira is close to the edge of the modern range of the Desert Pocket Gopher which has been recorded as far north as the vicinity of San Antonio, New Mexico (Findley, Harris, Wilson, and Jones, 1975, p. 154).

Mound 7 produced some excellent gopher material, most of it from an Early Phase cistern.

Perognathus flavus, cf. *flavus*: minimum faunal count–1, less than 1% of the collection

The Silky Pocket Mouse is represented by a single individual that agrees well with modern comparative specimens (cf. Hall and Kelson, 1959, pp. 478-480).

Dipodomys sp., cf. *ordii*: minimum faunal count–1, less than 1% of the collection

A species has been suggested because Ord's Kangaroo Rat (*Dipodomys ordii*) has been collected at Gran Quivira in modern times (ibid., pp. 515, 530, 531).

Dipodomys spectabilis baileyi: minimum faunal count–3, less than 1% of the collection

Mound 7 yielded good cranial material of the Banner-tailed Kangaroo Rat (ibid., p. 528).

Peromyscus sp.: minimum faunal count–2, less than 1% of the collection

The two specimens of New World White-footed Mice or Deer Mice recovered from Mound 7 are insufficient to attempt assignment to any of the species found in the area. Most of the small rodent remains were recovered from the fine screenings of burials. From the evidence of gnawed bone, mice were numerous in the pueblo–probably coming in from the surrounding area as fall approached, much as they do in the less populated areas today.

Neotoma sp., cf. *N. a. albigula* and *N. micropus canescens*: minimum faunal count–21, 1.35% of the collection

The wood rat is the second most numerous rodent in the Mound 7 collection, exceeded only by the prairie dog. Wood rats from Las Humanas appear to be predominantly the White-throated Wood Rat (*N. a. albigula*), with only four individuals assigned to the Southern Plains Wood Rat (*N. micropus canescens*). *N. albigula* and *N. micropus* occupy the same life zones, but never the same habitats at the same time. *N. albigula* prefers rocks, crevices in cliffs, and ledges, but will sometimes occupy flat ground when the common flatland form, *N. micropus*, is absent. Both species built their flatland homes in the same fashion–symmetrical constructions around bushes, yuccas, and trees (V. Bailey, 1931, p. 173).

Bailey (ibid., p. 180) reported that "their flesh is as tender, sweet and delicious as young rabbit or quail."

Erethizon dorsatum cousei: minimum faunal count–2, less than 1% of the collection

Porcupines display an unusual diversity in size and rugosity of skeletal elements, apparently influenced both by age and sexual dimorphism (Struthers, in Seton, 1929, pp. 604 and 605). Only one species and subspecies occur in the entire area (Hall and Kelson, 1959, p. 780).

Carnivora sp: not present in unworked bone collection
[Artifacts: 1 specimen, less than 1% of the collection

A short tube has been worked from the left femur of an adult unknown carnivore.

Canis sp.: minimum faunal count–4, less than 1% of the collection
[Artifacts: 7 specimens, 1.23% of worked mammal bone

Seven worked specimens have been assigned to wolf/dog because of finely finished surfaces and lack of adequate wolf comparative material. Five have been worked from the metacarpals, one from the radius, and one from the femur. One young adult and six adults are represented.

Unworked bone in this category represents pups so immature they have not been assigned to species.

Canis lupus nubilus: minimum faunal count–2, less than 1% of the collection
[Artifacts: 4 specimens, less that 1% of worked mammal bone

The artifacts have been worked from three metatarsals and from the femur of one young adult and three adults of both large and small size. Both sexes may be present.

Gray Wolf remains from Gran Quivira refuse bone ran rather large, reinforcing the assignment of these specimens to *C. l. nubilus,* the subspecies common on the plains. In addition this subspecies has been collected in modern times at Mountainair, New Mexico, near Gran Quivira National Monument (Hall and Kelson, 1959, p. 850; Young and Goldman, 1944, pt. II, p. 445).

Canis familiaris: minimum faunal count–11, less than 1% of the collection
[Artifacts: 3 specimens, less than 1% of worked mammal bone

The domestic dog is represented in the worked bone by two cut-off ends of long bones from a left tibia and a right femur. These fragments are probably discards from the manufacture of two other artifacts that were not recovered. The third specimen is a tubular haft for an iron tool that has been worked from the right femur of an adult dog of small size.

Three types of dogs are represented in the Mound 7 unworked bone collection. One type, represented by parts of a left hind leg, resembles the Plains Indian Dog described by Allen (1920, pp. 449–454). These dogs, used by native buffalo-hunting groups to the north to draw travois, were described in 1599 by Don Juan de Oñate:

> To carry this load, the poles that they use to set it up, and a knapsack of meat and their *pinole*, or maize, the Indians use a medium-sized shaggy dog, which is their substitute for mules. They drive great trains of them. Each, girt round its breast and haunches, and carrying a load of flour of at least one hundred pounds, travels as fast as his master. It is a sight worth seeing and very laughable to see them travelling, the ends of the poles dragging on the ground, nearly all of them snarling in their encounters, travelling one after another on their journey. In order to load them the Indian women seize their heads between their knees and thus load them, or adjust the load, which is seldom required, because they travel along at a steady gait as if they had been trained by means of reins (Bolton, 1916, p. 227).

A second type of domestic dog is a rather small dog similar in size and proportion to those recovered during the excavation of Pueblo del Arroyo in Chaco Canyon. It is represented by a right tibia measuring 130.1 mm. in length. There are a number of cuts on the distal shaft, some of which appear to have been made with a metal tool.

The predominant dog at Las Humanas, however, is small and gracile, with a narrow muzzle. Of the nine samples examined, five are pups of various ages, and four are adults. A male of this breed stood about 16 inches at the shoulder and is apparently the Small Indian Dog, or Techichi, described by Allen (1920, p. 482).

A nearly complete male of this breed was found buried in a pit under the floor of Kiva M, lying on its left side with its head to the north. It had been struck at least four times on the head. Cuts made while the bone was fresh indicate that it may have been skinned. The seven distal caudal vertebrae, the right front fifth claw, and the left dew claw are missing, and may have been removed with the skin. The chest cavity was opened, as indicated by broken vertebral heads of some ribs and cuts on the inner face of the ribs made while the bone was still fresh (cf. table 29 for measurements).

In the same pit with the dog, and 8 inches south of it, was a small, immature turkey, female in size, which had been struck a single blow on the right occipito-parietal area. The sternum of this bird, which had been broken from the ribs, was missing, as were the legs and the two caudal vertebrae and pygostyle to which the tail feathers were attached. A similar matting-covered pit was found in Kiva K, but it contained a cache of hammerstones rather than animal remains.

Canis latrans, cf. *texensis*: minimum faunal count–15, less than 1% of the collection
[Artifacts: 17 specimens, 2.99% of worked mammal bone

Coyote bone artifacts are the most numerous of the Canidae, exceeding the total for all other canid identifications. Artifacts were worked from five metatarsals, three metacarpals, three femora, three humeri, two radii, and one tibia. Two individuals are young adults, a small female and a large male. The adult individuals are represented by two small females, one medium specimen (sex unknown), and 12 large males.

The subspecies of coyote found in the Gran Quivira area today is *C. l. texensis* (Hall and Kelson, 1959, p. 845), which V. Bailey (1931, p. 312) described as rather large. This description agrees well with the specimens recovered from Mound 7, which tend to run consistently larger than modern comparative specimens from Arizona which belong to a smaller subspecies.

Summarizing the canids, coyotes are the most numerous, both in artifacts and in refuse bone. Artifacts exceed samples of unworked bone among wolf/dog, wolf, and coyote, but domestic dog appears more often in refuse bone than as artifacts.

Vulpes macrotis neomexicana: minimum faunal count–3, less than 1% of the collection
[Artifacts: 1 specimen, less than 1% of worked mammal bone

In worked bone the Kit Fox is represented by the cut-off distal articular end of the left humerus of an adult.

Gran Quivira lies on the northeastern margin of the present range of the Kit Fox. V. Bailey (1931, p. 299) reported that this little fox preferred the mesa country, whereas the Gray Fox needed more cover (cf. Hall and Kelson, 1959, p. 859). Although absent from the Mound 7 collection, the Gray Fox is reported for House A at Gran Quivira (Vivian, 1964, p. 137).

Of 33 artifacts from canid and vulpid skeletal material, 25 are tubes, one of which is a tubular haft, and another a tube blank; six are cut-off heads probably resulting from tube manufacture, and only two are awls. The tubes are of two types: small tubes from metacarpals and metatarsals, and large ones from appendicular long bones.

Ursus sp.: no unworked specimens
[Artifacts: 2 specimens, less than 1% of worked mammal bone

Bears are represented by two ribs (central series) from one or more sub-adults. The distal ends have been removed and rounded, and the shafts smoothed. No Grizzly Bears have been identified at Gran Quivira, but these young specimens do not eliminate this possibility.

Ursus americanus amblyceps: minimum faunal count–3, less than 1% of the collection
[Artifacts: 1 specimen, less than 1% of worked mammal bone

Few specimens of worked Black Bear bone have been identified in Southwestern artifact collections north of the Mexican border; there are one or two occurrences from each of a limited number of sites, one of which is Kinishba. Larger numbers of both worked and unworked bear bones have been recovered from the excavation at Casas Grandes, Chihuahua.

Mound 7 produced a flaker made from the proximal head and midsection of the shaft of the right fibula of a medium sized adult Black Bear. In Room 8 of Mound 15–adjacent to Mound 7 and contemporaneous with its Late Phase–an artifact was found that consists of the distal articular head and partial shaft of the right femur of a medium-sized adult Black Bear. The shaft has been cut diagonally, and the projecting edge of the bone provided with notches.

Three specimens of Black Bear were recovered from Mound 7 refuse bone–long bones of an immature and an adult, and a terminal phalanx, minus the claw, which may have served as an ornament. Black Bear bone has been reported from refuse at Ventana Cave (Haury, 1950; p. 151), Nalakihu (King, 1949; p. 141), and Pecos (Kidder, 1932; p. 195), and from an offering cache and refuse at Pueblo Bonito (Judd, 1954, p. 65; cf. Hall and Kelson, 1959, p. 866).

Procyon lotor: minimum faunal count–1, less than 1% of the collection

As recently as 1931, V. Bailey reported Raccoons to be common only along streams in New Mexico and apparently absent over large dry areas. Raccoon bone has been recovered from Tuzigoot (Caywood and Spicer, 1935, p. 68), Mogollon Village (Haury, 1936a, p. 6), and Point of Pines (Stein, 1963, p. 215)–all sites on or near water. The single bone recovered from the Late Phase room fill of Mound 7 could have been brought in from the Rio Grande Valley, or, since it is quite young, it may be from a modern pet brought in from another area. It is interesting that of all mammals identified from Mound 7, the Raccoon is the only one not found in the Franciscan Fathers' *An Ethnologic Dictionary of the Navajo Language.*

Taxidea taxus, cf. *berlandieri* (Hall and Kelson, 1959, p. 927): minimum faunal count–4, less than 1% of the collection

Considering the variety of burrowing rodents in the Mound 7 collection, it is not surprising that the Badger, which preys on them, is also present. Small numbers of Badger bones have been recovered from scattered sites in the Southwest.

Spilogale gracilis (cf. *gracilis*, Hall and Kelson, 1959, p. 927): minimum faunal count–1, less than 1% of the collection

The Western Spotted Skunk is the only skunk so far identified with Mound 7.

Felidae sp.: minimum faunal count–1, less than 1% of the collection

One specimen, the distal articular head of a humerus, is so much larger than either archeological or modern comparative specimens of Bobcat that it has been referred to family; it has not been compared with Lynx (*Lynx canadensis*). Although *L. canadensis* has been reported from southwestern Colorado in historic times, it is not known there today. It has never been reported from New Mexico (Hall and Kelson, 1959, p. 968).

Felis domesticus: minimum faunal count–1, less than 1% of the collection

One specimen of domestic cat was recovered from the excavation of Mound 7. The size of a large, old tom, it may have served to rid the *convento* of San Buenaventura of the mice that appear to have been so numerous.

Felis concolor: not present in unworked bone collection
[Artifacts: 3 specimens, less than 1% of worked mammal bone

Three metatarsal shaft tubes are identified as Mountain Lion, an unusual occurrence for the Southwest, although Vivian (1964) recovered right metatarsals 2, 3, and 4, displaying longitudinal scraping, from House A.

Lynx rufus: minimum faunal count–3, less than 1% of the collection
[Artifacts: 13 specimens, 2.28% of worked mammal bone

Worked Bobcat bone was derived from two young adults, a small adult female, a medium adult, and six large and three extremely large males. Artifacts were worked from six humeri, three femora, two metatarsals, a tibia, and a radius.

Since both worked and unworked Bobcat bone runs larger than modern comparative specimens, subspecies has not been assigned. Although Hall and Kelson (1959, p. 970) listed *L. r. baileyi* as the only subspecies now present in the state, V. Bailey (1931, p. 294) listed specimens from New Mexico attributed to the large Mountain Bobcat: "Apparently this large Rocky Mountain Bobcat extends southward in the higher mountains of northern New Mexico and along the Manzano and Sacramento chain of ranges between the Pecos and Rio Grande Valleys." Las Humanas lies between the Manzano Mountains and the Capitan Mountains, where the southernmost specimen was collected.

From all cat-like carnivores, 16 artifacts may be divided into 11 tubes and five cut-off ends—refuse from tube manufacture. Mountain Lion and Bobcat constitute a higher percentage of worked bone than of refuse bone.

Equus sp.: minimum faunal count—3, less than 1% of the collection

Three immature individuals may have been either horse or mule. Horses, mules, and burros were brought in by Oñate's colonists in 1598 (Hammond and Rey, 1953, p. 147).

Equus caballus: minimum faunal count—13, less than 1% of the collection

[Artifacts: 5 specimens, less than 1% of worked bone

Mound 7 yielded five specimens of the Domestic Horse, indicating use for artifacts after the colonization of what is now New Mexico. This is the only introduced domestic animal appearing in the artifact collection. Two large shaft splinters from tibiae show considerable use-polish along the side, and may be beamers. The cancellous tissue from the proximal heads of three humeri of one large and two medium-sized individuals was dressed down for use as rubbing or fleshing tools. These cancellous artifacts are identical in element derivation and form to those discussed later under *Bos/Bison.*

Horse bone, like almost all other refuse bone, was broken into very small fragments. The Domestic Horse was apparently eaten, although not nearly in the quantity that Domestic Cattle were consumed.

Artiodactyla sp.: minimum faunal count—34, 2.18% of the collection

[Artifacts: 79 specimens, 13.88% of worked mammal bone

Even-toed ruminants constitute 81.02 percent of all worked mammal bone. This order has the highest frequency and percentage in the mammalian collection from Mound 7; in fact, the values are unusually high for sites in the Southwest. Of unknown artiodactyl artifacts that could be assigned to element, 62 were worked from metapodials, six from ribs, two from tibiae, and one each from the radius and ulna. Sixty-three of the 79 artifacts are awls.

Unworked bone in this category contains, chiefly, very immature young of the medium-sized artiodactyls. Pronghorn should predominate, with probably a few deer. Sheep or goats may have been added during the Late Phase. These extremely young individuals were taken during the first week or two of life when they are known to employ a protective "freeze," lying motionless and flat to the ground while the mother feeds. There was very little utilization of intermediate age classes of artiodactyls until growth was nearly completed.

Sus scrofa: minimum faunal count—1, less than 1% of the collection

As late as 1761 Fray Serrano mentioned hogs as being few in number in New Mexico (Hackett, 1937, p. 484).

Cervidae sp.: Not present in unworked bone collection

A large artifact from Burial 271 that appears to have been a pectoral ornament has been referred to unknown cervid. Worked from the beam and tine fork of a large antler, the tabulum has been thinned, perhaps steamed, and flattened into a sheet. Assuming that the entire circumference of the beam was used, the width of the flattened artifact indicates that it could have come from a Mule Deer of average size.

Specimens referred to the deer family constitute 21.44 percent of the mammal artifacts, the second highest percentage value from Mound 7. This specimen number exceeded only by the Bovinae.

Odocoileus sp.: minimum faunal count—9, less than 1% of the collection

[Artifacts: 38 specimens, 6.68% of mammal artifacts

This group is composed entirely of fragments of deer antlers. Antler tine artifacts with wear-facets at the tip total 16 examples. Antler beams were cut into sections for hafts, or sawed lengthwise into narrow strips from which awls and flakers were made.

Odocoileus hemionus, cf. *hemionus*: minimum faunal count—83, 5.32% of the collection

[Artifacts: 81 specimens, 14.24% of worked mammal bone

Metatarsal awls total 36, constituting almost half the Mule Deer artifacts. Tibiae, metacarpals, ulnae, radii, scapulae, and ribs were used in decreasing order of importance.

Throughout the time span represented by the collections from Las Humanas, the artiodactyls provided the bulk of the available meat. Mule Deer in the collection are extremely large, as are those still plentiful in the area today (Hall and Kelson, 1959, p. 1005). Both males and females occur in the collection, as do immatures, young adults, and adults. The immatures (with epiphyses yet unfused and young adults, with the epiphyseal line still visible) are large in size and would have provided a considerable quantity of meat.

There is a shift in the numbers of Mule Deer recovered from period to period. In the Early Phase Mule Deer individuals constituted 5.61% of the collection, increasing to 9.16 percent in the Middle Phase, and then dropping to 4.27 percent in the Late Phase with the introduction of domestic animals.

Odocoileus virginianus texanus: minimum faunal count—46, 2.88% of the collection

[Artifacts: 2 specimens, less than 1% of worked mammal bone

Only two examples of worked White-tailed Deer bone occur. Both are awls, one metacarpal and one tibial.

Like Mule Deer, the unworked Whitetail sample from Mound 7 contains both sexes. Immature, young adult, and adult individuals are present. One fawn was identified; otherwise, the specimens are nearly full-sized, although they may not be mature. The sample runs consistently large and compares well with a modern specimen of *O. v. texanus* (cf. Hall and Kelson, 1959, p. 1009).

Whitetails are not found in the vicinity of Gran Quivira today, and probably were not there in any quantity in prehistoric or colonial times—a fact that is reflected in the consistently low numbers which appear in the collection. White-tailed Deer made up 1.53 percent of the collection in the Early Phase, and 1.09 percent in the Middle Phase. However, the percentage increased to 2.56 percent in the Late Phase, despite the introduction of domestic animals. This may reflect socio-economic factors.

The deer family sample includes animals of both sexes and of all age classes, but most tools are made from the bones of large adults, probably males. This selection may be utilitarian, with the large, mature skeletal elements offering more durable material.

Antilocapra americana americana: minimum faunal count—560, 35.87% of the collection
[Artifacts: 112 specimens, 19.67% of worked mammal bone

Use of front and hind limb elements for artifacts is nearly equal among Pronghorn. Metatarsals, metacarpals, ulnae, tibae, scapulae, horn cores, and femora are utilized in decreasing frequencies.

Pronghorns in the Southwest travel in bands of a few to more than a hundred individuals, depending on population density. In a single day, they wander over perhaps a square mile, feeding on weeds and forbs, and utilize a year-round range about 10 miles in diameter. For most of the year bands contain males, females, and young, but by late August the most vigorous bucks gather harems of two to a dozen does. Weaker bucks are driven off, and the young form temporary bands for the duration of the breeding season, which lasts through September. The young, usually two, are born after a gestation period of 7½ months. The April fawns remain quiet for the first two weeks, but by the time they are a month old, or in May, they are able to follow the mother (Leopold, 1959, pp. 520 and 521).

Extremely large male antelopes occurred in the Early and Middle Phase samples, and were particularly conspicuous during the Early Phase. What few male antelopes could be distinguished in the Late Phase sample were little if any larger than the adult females and could be differentiated mainly by the rugosity of the attachments, the larger size of the joints, and the indications of a more massive neck and heavier head, which is carried lower than that of the female.

A tally of 559 aged individuals from Mound 7 produced the age classes shown in Table 30. The empty class for young immatures could be interpreted as a deliberate avoidance of small animals, but, more probably, it reflects the preoccupation of the people with agricultural activities during the summer. The very immature artiodactyls were so fragmentary that most are referred simply to Artiodactyl. Undoubtedly the majority of this class is pronghorn.

Age classes observed in the much smaller deer samples follow the same general pattern of distribution as the pronghorn.

Bovinae sp.: minimum faunal count—62, 3.97% of the collection.

The Late Phase sample contains the remains of a number of individuals too fragmentary or too immature to identify either as Domestic Cattle or bison; these have been referred to Bovinae. Since no artifacts can be definitely identified as from Domestic Cattle, Late Phase bovine artifacts are discussed under the American Bison.

Bos taurus: minimum faunal count—26, 1.67% of the collection

An interesting dispute concerning Las Humanas arose between the civil and religious authorities, Nicolás de Aguilar and Fray Diego de Santander. In question was how much livestock the mission maintained, and whether or not the Indians were forced into unnecessary labor to draw water for the herds in such a quantity that there was an inadequate supply for the people. The disputants did not agree as to the actual numbers of animals involved, but it seems certain that about A.D. 1660, Indian herders drove 20 or 30 horses, 20 oxen, and 700 sheep to Abó because of a scarcity of water. In 1661, Fray Nicolás de Freitas maintained that Las Humanas had only 400 sheep and goats and six or eight plow-oxen (Hackett, 1937, pp. 142 and 162).

More extensive reading of the trial of Nicolás de Aguilar (ibid.) gives evidence that the aboriginal economy had collapsed even before the abandonment of Las Humanas. The religious authorities complained repeatedly of large expenditures for grain to feed the Indians during the winter. The introduction of herds of sheep and goats, which would have competed directly with the antelope for food, and of cattle and horses, which consumed great quantities of water, must have drastically affected the availability of game close to the pueblo. Late Phase samples indicate an abrupt transition from those that are predominantly pronghorn to others that are mainly domestic cattle.

If cattle were not kept at Las Humanas for other than draft purposes, it would have been possible for Indian herders to drive beef cattle down from the mission herd at Abó for processing at Las Humanas.

Like native mammals in the Mound 7 collection, domestic cattle specimens are large. Whether this is a reflection of local conditions or of breed is uncertain. The animals are predominantly young, of an ideal butchering age. One very large and extremely stocky, adult individual is probably an ox.

Bison bison: minimum faunal count—59, 3.14% of the collection
[Artifacts: 27 American Bison, 121 *Bos/Bison*, 24.25% of worked mammal bone

One hundred and forty-eight worked bovid specimens, including 27 American Bison and 121 *Bos/Bison* (which are presumed to be American Bison), constitute the largest taxonomic category of worked bone recovered from Mound 7. Although some individuals are designated as medium in size, and probably female, most of the artifacts are from large to very large individuals.

Rib tools are highest in frequency, but the extensive use of this element may be simply a case of availability. Second in number are artifacts made from scapulae. Few tools were formed on elements of the appendicular skeleton. One metatarsal awl and one tibial awl were uncovered. The proximal articular heads of five humeri were worked into flattened, hemispherical abraders of cancellous tissue (Kidder, 1932, p. 236).

Capra sp.: minimum faunal count—5, less than 1% of the collection

The goat is not well represented in the Mound 7 collection. Two very immature kids cannot be identified other than as goat; however, the adult individuals more closely resemble modern specimens of the Angora Goat (*C. falconeri*) than they do the larger, more rangy Milk Goat (*C. hirca*).

Ovis canadensis: minimum faunal count–2, less than 1% of the collection

The present range of Bighorn Sheep does not include Gran Quivira. To the north, the closest range is the Sandia Mountains, to the west, the mountains beyond the Rio Grande, and to the south, the Guadalupes. The absence of worked Bighorn bone suggests that this species was neither regularly hunted nor commonly traded.

Ovis aries: minimum faunal count–20, less than 1% of the collection

Sheep remains from Mound 7 are of two sizes. One is a small type similar to specimens recovered from the excavations at Cuyamungue. The others are larger and more rangy, and may represent wethers raised for their meat as well as for wool. According to Underhill (1958, pp. 84 and 85) Oñate brought with him 3,000 *churro* sheep, the common sheep of Spain. Able to live in the arid Southwest, it produced long, straight wool that was easy to process by hand.

Sheep are exceeded in the Late Phase sample by Domestic Cattle, although records show that sheep were more numerous at Las Humanas (Hackett, 1937, p. 162). This may indicate their use for wool more than for meat.

Summary of Mammal Remains

All native mammalian species identified from Mound 7 have been recovered from other Southwestern archeological excavations, and, with the exception of the bison and the prairie dog, which were exterminated by man, they are still found in the general area. Species represented reflect primary usage of faunal resources from the grasslands, less from the pinyon-juniper woodlands, and very little from riparian sources.

There is some variation in frequencies of artiodactyls during the three periods. Mule Deer, pronghorn, and bison frequencies are highest in the Middle Phase. White-tailed Deer, which are infrequent throughout all periods, appear to increase during the Late Phase. The most conspicuous change is the Late Phase introduction of cattle, sheep, and goats, with a simultaneous sharp drop in the number of pronghorns.

In meat produced by the mammals processed at Las Humanas, bison led native mammals during all periods, followed by pronghorns. However, introduced domestic animals exceeded bison in meat production in the Late Phase sample, even though they are not recorded in substantial numbers at Las Humanas before late A.D. 1659 (Hackett, 1937, p. 142).

Domestic Swine are present in limited numbers at Mound 7. They were never common in colonial New Mexico, and the date of their introduction is in question. The most probable period for their utilization at Las Humanas would have been between A.D. 1659 and 1672.

The only indications of a possible surplus of faunal resources are the presence, in Early Phase samples, of unbroken long bones of pronghorns, from which the marrow had not been extracted, and the brain cases of deer, from which the facial parts had been removed as if to store the brain for future use.

Conclusions

When the study of these collections began, it was hoped the faunal remains would provide information that would cast some light on the changes wrought during the pre-Rebellion segment of the Spanish period in New Mexico on the native culture of Las Humanas, but it was less hispanic than had at first been supposed.

As early as the late 1200's, we find a standardized breed of domestic turkey being raised that is unlike turkeys raised in most other areas of the Southwest. The other domestic animal was the dog, predominantly a small, gracile strain. Artiodactyls produced the greatest portion of meat, hides, sinew, tallow, and bone for heavy-duty tools. Turkeys and the hawk-like birds seem to have been desired mainly for their feathers. Bones of birds and carnivores were used to fashion a wide variety of tubes–some no doubt intended as items of adornment, others modified to form flutes and whistles.

Trade from beyond a 50-mile radius of Gran Quivira brought such items as marine shell from the northern part of the Gulf of California and the Pacific Coast, freshwater mussel shell probably from what is now Texas, and Scarlet Macaws from Mexico.

Although tool types remain standard throughout the occupation of Mound 7, there is a shift in species utilized. Since artiodactyls and turkeys are closely related to the basic subsistence pattern, and since tools made from their bones are more often utilitarian, they have been used as a base against which to measure increases in frequencies of hawks, eagles, and carnivores. In the Early Phase hawk and eagle bone tools exceeded those from turkeys by 300 percent, in the Middle Phase 460 percent, and in the Late Phase by 560 percent. Artifacts made from carnivore bones totaled 4.5 percent of those of native artiodactyls in the Early Phase, 11.5 percent in the Middle Phase, and 20 percent in the Late Phase. If lumping of categories has been sufficient to offset discrepancies in sample size, these increases substantiate the efflorescence of tube manufacture apparent in the worked bone collection.

Changes brought about by the Spaniard's introduction of the domestic chicken, cat, horse, swine, cattle, sheep, and goat were late, probably about A.D. 1659, and abrupt. Pronghorns were replaced by Domestic Cattle as the major portion of each faunal sample. This late dependence on domestic animals, particularly cattle, was so heavy that they account for 43.71 percent of the usable meat potentially available during the entire Late Phase.

Climatic conditions may be inferred from the avian list. The prevalence of Dabbling Ducks contrasted with the scarcity of Diving Ducks and Coots, which require deep permanent water and emergent vegetation, indicates that during the occupation of Las Humanas, as now, water was scarce and ponds were of an intermittent nature.

6. A Petrographic Study of the Pottery

A.H. Warren

Introduction

During the analysis of archeological materials excavated at Gran Quivira during 1967, numerous questions of a technical or cultural nature arose concerning the ceramic assemblage. To what extent were glaze-decorated wares made locally at Gran Quivira? How much was imported, and from what sources? Did the Tabirá pottery develop from earlier Chupadero wares? In order to obtain additional information to help answer these and other questions, a petrographic study of the pottery from Gran Quivira was made. Approximately 1,200 sherds, representing all pottery types at the site, were examined. In addition, available sherds from five other sites in the vicinity were studied.

The results of the study include interpretation or significance of accumulated data for each glaze group, descriptions of major temper types occurring at Gran Quivira, source and extent of trade ware for each ceramic type by site, and probable sources of tempering materials.

Since it was possible to identify the manufacturing centers of glaze wares (at least on an areal basis) by a process of elimination, it was found that only a small percentage—not over 5 percent—of the glaze-decorated wares at Gran Quivira had been made locally. Two faceted and grooved specimens of galena with barite found during the excavations at Mound 7 may have been the type of lead ore used for glazing pottery. It would appear that during the years of occupation at Mound 7, an occasional glaze potter was in residence.

During the early glaze periods, perhaps up to A.D. 1450, practically all the glaze pottery at the sites studied had been imported from villages along the Rio Grande, with lesser amounts coming from other villages in the north. Intrusive wares from northern trade centers, such as the Galisteo Basin between A.D. 1350 and 1450, and Tonque Pueblo from 1425 to 1525, were present at Gran Quivira; however, a period of non-occupation of Mound 7, or cessation ot trade, is suggested by the absence of the popular mid-16th century Puaray Glaze-polychrome from Tonque.

A ceramic industry developed at Abó Pueblo during Glaze C times, and possibly at one or two of the neighboring villages of the Tompiro division, which supplied most of the glaze decorated pottery to nearby villages and to the Jornada area until after A.D. 1600. Shortly after this period, another source of glaze ware developed at Quarai. Both Abó and Quarai continued to supply trade pottery to the Salines area until they were abandoned (A.D. 1675).

Chupadero and Tabirá Black-on-white, the major white wares at Mound 7, appear to have been made at Gran Quivira. Differences in tempering material between the two wares suggest that they were made by two different groups of people, and that an outside group migrated to the site at the time Tabirá made its appearance. Temper differences indicate a similar division between the early corrugated and the later plain utility types. Although the Chupadero and Tabirá wares were traded in limited amounts to neighboring villages, most of the trade in pottery was to Gran Quivira from the glaze villages of the Los Lunas, Abó, and Quarai areas.

Temper Materials

A total of 26 temper categories were used to tabulate the various types that occurred in the 1,200 sherds examined from Gran Quivira. Some of the categories may represent more than one type or center of manufacture, but because of the small number of sherds involved, a category was used to represent the general classification. These categories are listed briefly, along with salient megascopic characteristics. All sherds were examined with a stereomicroscope, while optical properties were determined by examination with a petrographic microscope using the oil immersion method. All color determinations were made with Munsell color designations (Munsell Color Co., 1954) and the I.S.C.C.–NBS system of names wherever possible (Rock Color Chart, Geological Society of America, 1963). The temper types presented here are listed in the order that they appear in Table 31.

I. *Vesicular basalt*: reddish brown to reddish gray, with angular fragments; vesicles sparse; at least two types of clay are represented, one a coarse granular moderate reddish brown, and the other a pale-red clay with a light-gray core. The first clay type may be indigenous to Pottery Mound (LA:416) near Los Lunas. This is probably one variety of "vitrophyric basalt" temper described by Shepard (1942, p. 243).

San Felipe basalt: a fine-grained, granular, holocrystalline basalt with augite and some olivine; reddish brown clay; center of production in the Santo Domingo Valley near San Felipe; mainly a Glaze A type. This corresponds in part to the "intergranular basalt" of Shepard (1942, p. 243).

Zia basalt: a fine-grained holocrystalline diabase basalt with ophitic texture; reddish brown clay; corresponds to Shepard's "ophitic basalt" (1942, p. 241); trade ware mainly after 1600. There is a possibility that a similar, diabase was used elsewhere in the lower Middle Rio Grande.

Miscellaneous basalt: miscellaneous holocrystalline, fine-grained basalts; various clays; minor occurrence; locations unknown.

II. *Crushed sherds*: various types including white, cream, to orange colors in white, cream, buff, or light-gray clay matrix; mainly from the Acoma area, but Zuñi sources may be present.

Crushed sherds: varicolored angular sherd fragments in a moderate reddish orange (10 R6/6); compact, finely granular clay with occasional pinkish lavender streaks and medium-gray core; center of manufacture unknown, but probably Albuquerque area or south.

Crushed sherds: miscellaneous—varicolored sherd fragments in orange to red clays.

III. *Biotite felsite:* a fine-grained holocrystalline rock, characterized by pale gold mica flakes in a porcellanous white feldspar matrix; a local temper type at Gran Quivira, mainly in Tabirá Black-on-white.

Hornblende syenite: a fine-grained, light colored igneous rock characterized by resinous reddish brown rods of hornblende in a white feldspar matrix; temper used at Abó Pueblo (LA:97); trade ware mainly in Group C through F glazes.

San Marcos latite: a fine-grained, light colored igneous rock characterized by red laths in a white feldspar groundmass; used at San Marcos Pueblo (LA:98); trade ware mainly Glaze A Yellow, Largo, and Espinoso glazes; in part, the intermediate igneous or "andesite" temper of the Galisteo Basin (Shepard, 1942).

Augite latite: a fine-grained, light colored, intermediate igneous rock; miscellaneous sites in the Galisteo Basin; mainly orange-red clay with yellow-brown core; in part, "andesite" temper of the Galisteo villages (Shepard, 1942).

Intermediate igneous: miscellaneous, light colored igneous rock; possibly a latite from the Galisteo area, but source unknown.

IV. *Tonque latite*: a very fine-grained, intermediate volcanic rock characterized by shiny black laths of hornblende; buff to orange clay; indigenous to Tonque Pueblo (LA: 240); one of the "andesite" or intermediate igneous temper types of the Galisteo area (Shepard, 1942); trade mainly Glazes C through E.

Hornblende latite: rock as in Tonque latite, but usually with red colored clay matrix; in part from the Galisteo area, in part from San Felipe. A "sandy hornblende latite" is from the Galisteo, possibly San Lázaro (LA:91)."

V. *Rhyolite tuff*: a welded tuff with crystals of vitreous quartz and feldspar grains in a light colored matrix; source —the Pajarito Plateau, the Cochití area, and south to Bernalillo; same as Shepard's "devitrified tuff" (1942, p. 217).

Metarhyolite (?): fresh feldspar crystals and dark minerals in a lavender-pink vesicular, cryptocrystalline matrix; orange to light yellow-brown clay; source unknown, but probably from lower Middle Rio Grande.

Vitric tuff: pumice sherds and tuff fragments, with or without quartz sand; used by potters in the Tewa villages from northern Rio Grande.

Crystal vitrophyre: dark-gray to black groundmass with visible phenocrysts; includes andesite vitrophyre of the Pajarito, although other areas may also have used vitrophyre; miscellaneous clays.

Glassy scoria: a highly vesicular brownish black glass; orange-pink to medium-gray clay; may be the same as "tachylite" described by Shepard (1942, p. 246).

VI. *Calcite and shale*: cryptocrystalline calcite fragments and rounded fragments of shale or claystone; tempering material of Chupadero Black-on-white at Gran Quivira; light brownish gray clay.

Pecos sandstone: fine-grained quartz grains with mica, in dark-red and gray compact clay; used as temper at Pecos Pueblo; trade mainly after 1600.

Sandstones, miscellaneous: medium to coarse grains of quartz; various cements; occasional sandstone fragments, with some crushed quartzite on occasion; found as temper most frequently in the Quarai, or East Tiwa, district.

Hornblende gneiss: characterized by reddish black, splintery prisms of hornblende; varied clay types; occurs as temper mainly in the Quarai, or East Tiwa, district, during historic period.

Quartz mica schist: different types; usually a very fine quartz mosaic with mica flakes in decussate (criss-cross) pattern; mainly occurs in corrugated culinary ware at Gran Quivira; possibly local use.

Glaze-Decorated Wares

The glaze-decorated wares from Gran Quivira exhibit a marked heterogeneity in physical characteristics through time—a circumstance that should be expected in a site which imported glaze pottery while manufacturing very little at home (table 31). The white wares at Gran Quivira show a marked consistency in both temper and clay, pointing to local manufacture, in contrast to the diversity of the imported glaze wares. The distribution patterns of the various temper types have indicated manufacturing centers of glaze wares at villages north and west of Gran Quivira, and the finding of source rocks at these villages confirms local manufacture. Discovering the biotite felsite used in locally made pottery at Gran Quivira adds to the evidence that less than 5 percent of the glaze pottery excavated at Mound 7 was actually made there.

Early and Western Glazes.

Although early western glaze decorated sherds constituted only a small percentage of the total glaze wares excavated at Gran Quivira, the 93 sherds available for study indicated a wide range of source areas. Approximately 75 percent were tempered with crushed sherds, although clay and sherd temper varied. The largest homogeneous group with a cream colored clay (37.6 percent) may have been traded from the Acoma area. Another group with a red colored compact clay (24.8 percent) very probably came from an unidentified site that was engaged in extensive trade during early glaze and Glaze A times—largely in the 14th century. About 14 percent of the sherds contained a reddish brown vesicular basalt temper and a granular reddish brown clay matrix, similar to the temper and clay of the Pottery Mound ceramics near Los Lunas. Possibly 3 percent of the sherds contained the type of igneous rock temper, which points to manufacture at Gran Quivira. There is no evidence of trade from the upper Middle Rio Grande area during this time.

Many of the early glazes do not fit precisely into a described type, although those made in the Rio Grande area could be included in the indefinite transitional type, Los Padillas Glaze –Polychrome. Temper and clay similarities indicate that the variants were being made by the same potters, but with different combination in different areas.

Glaze A Pottery (A.D. 1315-1425)

The wide range of temper and clay types characteristic of Agua Fria Glaze-red pottery at Gran Quivira indicates widespread trade and numerous sources of this particular type. This diversity is characteristic of the entire glaze area in the Rio Grande during this period.

Approximately one-third of the Agua Fria Glaze-red at Gran Quivira contained crushed sherd temper, and another one-third vesicular basalt. The former group had several clay types, indicating several sources. The white or cream colored clays of the western glazes were absent. Possibly the early trade from the Acoma area had ceased before Glaze A times. The largest group of sherd-tempered Agua Fria Glaze-red is similar to the second largest group of temper types of the western or early glazes already mentioned.

The vesicular basalt tempered sherds (33) percent) resemble the Agua Fria Glaze-red sherds from Pottery Mound, and may have been obtained in trade from that village. Only 3 percent of the Agua Fria sherds appeared to have been made locally, while about 4 percent contained the syenite temper of Abó Pueblo. Apparently some glaze potters were living at Gran Quivira at this time, when the ceramic industry at Abó was just beginning.

Minor amounts of Agua Fria Glaze-red vessels were obtained from the San Felipe and Tonque areas, and particularly from the Galisteo area. Most of the contact during this period, however, appears to have been with the villages south of Albuquerque.

San Clemente Glaze-polychrome, which is generally associated with Agua Fria both temporally and areally, has a similar distribution pattern of temper types, although its frequency ratio was about one to seven with Agua Fria.

Cieneguilla Glaze-yellow and Cieneguilla Glaze-polychrome, found in small quantities at Gran Quivira, was traded mainly from the Galisteo villages in the north. Possibly as much as 30 percent of these types may have been made in the lower Middle Rio Grande –that is, between Albuquerque and Socorro. There are no indications of local manufacture of early glaze-yellow wares at Gran Quivira.

Glaze B Pottery (A.D. 1400-1450)

Largo Glaze-yellow, Glaze-red, and Glaze-polychrome constituted less than 1 percent (0.9) of the Gran Quivira glaze decorated wares examined. Temper differences indicated that the glaze-red pottery is really distinct from the glaze-yellow types, and like San Clemente Glaze-polychrome, it is found in association with Agua Fria vessels. The glaze-red sherds appear to be from the southern villages, while the white or yellow slipped Glaze B sherds contained temper that was used in the Galisteo and Tonque Valleys.

Possibly contemporary with the Largo types is Pottery Mound Glaze-polychrome (Voll, 1961). Sixty percent of the sherds of this type contained the reddish brown vesicular basalt believed to be indigenous to the Pottery Mound village. At least one Largo Glaze-red vessel contained local Gran Quivira temper.

Glaze C Pottery (A.D. 1425-1490)

During the Glaze C period (A.D. 1450 to about 1500) a number of changes in trade patterns are reflected by changes in temper materials. Up to 15 percent of the Glaze C pottery was traded from the Galisteo area. Imports from the Los Lunas area, or Pottery Mound, which in earlier types had ranged from 15 to 60 percent, dropped off to less than 4 percent of the total Glaze C. This decrease in trade probably reflects the fact that Pottery Mound was abandoned during late Glaze C times (Voll, 1961).

Imports from the Tonquė Village, amounting to nearly 40 percent of all Espinoso Glaze-polychrome (Glaze C) pottery, indicate the ascendency of the trade industry at that site (Warren, 1969). It should be kept in mind, however, that the middle glaze rim forms may have developed at Tonque before they did at other glaze sites. An interesting sidelight is that the only Glaze D rim sherds in the Museum of New Mexico collection from Pottery Mound–primarily a Glaze C village– were from vessels made at Tonque Pueblo, suggesting that Glaze D imports were being made at Tonque before the type was adopted elsewhere.

During Glaze C time, pottery containing hornblende syenite temper from the Abó area appeared for the first time in appreciable amounts (29 percent) at Gran Quivira. This temper appears in 88 percent of the Glaze E and F sherds and in 91 percent of the Salinas Red ware sherds examined from Abó. As mentioned elsewhere elsewhere, this is very likely the same temper type as "soda diorite," described by Shepard (1942) from the Jornada and Salinas districts, and in part the "andesite" temper of Vivian (1964).

Two rim sherds with Pecos sandstone temper having the form of Glaze C pottery are of interest, since little trade is known from that village prior to A.D. 1600. According to Kidder (1936), Glaze III in the Pecos Pueblo classification was made for a longer period of time than Glaze C at other Rio Grande sites; in fact, it may even have continued past his suggested terminal date of 1550. Glaze III and IV rim sherds from Pecos have been found at a post-Rebellion (post-1680) site (LA:2047) at San Felipe, where there was little possibility of contamination from earlier sites.

Glaze D pottery (A.D. 1490-1515)

The percentage of trade ware from Tonque dropped to 25 percent in Glaze D sherds (post-1490) while that from Abó increased to 45 percent. A few sherds with vitrophyre temper may have been from the Kuaua-Puaray area, being megascopically similiar in both clay and temper.

Although the majority of the hornblende syenite tempered sherds have the dark-red granular clay found at Abó, a few have a light pinkish-orange granular clay. The source of the latter is not known, but it may have come from a nearby glaze site, such as LA: 200 near Scholle.

A number of the Glaze D (San Lázaro Glaze-polychrome) sherds from Abó show design similarities to those of the Tonque area, with red matte paint outlined by glaze, as well as dark orange-red slips (one pinkish white) and non-carinated thickened rims with outward beveling. Since Tonque wares were being traded to the Abó area at this time, the local copying of traits may be an indication of a diffusion of ceramic styles. A small percentage of the Group D vessels at Gran Quivira were made locally.

Glaze E Pottery (A.D. 1515–1650)

There appears to be an absence of trade wares during the middle decades of the 16th century at Gran Quivira. Except for a few Puaray Glaze-polychrome sherds of the "late" Tonque wares, no Glaze E sherds from Tonque were found at Gran Quivira, although the trade industry at Tonque was at its height during the 16th century. Either trade with the northern Rio Grande villages had completely ceased at this time, or there may have been a temporary abandonment of Mound 7. In general, all Glaze E pottery has a "late" appearance, perhaps from A.D. 1580 on, and transitional to Glaze F. However, since most of the pottery was being obtained from the Abó area, and since very little is known of the chronology of types at Abó, it is not now possible to make definite statements on the basis of pottery alone. The "Jornada Late Variant," described by Shepard (1942), includes the Glaze E types discussed here. Toulouse (1949) believed the Jornada Variant to be contemporary with the Glaze F type (Kotyití Glaze-polychrome), but since he studied only post-1600 material from Abó, it is possible that the Jornada Late Variant was made earlier, in Glaze E time.

Trade wares from the Quarai area first appear in the late Glaze E period, but constitute less than 10 percent of the total glaze sherds. This is consistent with the proportion of late Glaze E to Glaze F sherds at Quarai itself. The Quarai pottery contains a distinctive hornblende gneiss or schist temper that seems to have come into use for the first time after A.D. 1600.

A number of trade vessels from the upper Middle Rio Grande, including some from the Galisteo Basin, appeared during the late Glaze E period. A few rhyolite tuff-tempered sherds may have originated in the Tiguex villages near Bernalillo or on the Pajarito Plateau. Only one late Glaze E sherd with a high thickened rim from Tonque could be positively identified. Others with typical Tonque latite temper may post-date occupation at that site, and may have been traded from the San Felipe area, where the temper tradition was continued for nearly 100 years. Pottery made at San Felipe during this period is difficult to distinguish from that of the San Cristóbal Pueblo in the Galisteo Valley. Three of the Glaze E rims from Gran Quivira are of the Glaze E "M" type (Lambert, 1954), which can be tentatively dated between A.D. 1580 and 1630. These are convex on the outside with a direct perpendicular interior surface. Glaze E pottery made at Gran Quivira constituted less than 5 percent of the total.

Shouldered bowls of the 1600's, according to the tempering materials, came from Abó, Pa-ako (?), Pecos, and Quarai. Only red-surfaced shouldered bowls from Abó were noted.

Over 50 percent of the Glaze F sherds examined came from Quarai or its neighboring villages. Almost all *olla* sherds of this late period contained the hornblende schist used at Quarai. Approximately one-half of the Quarai Glaze F sherds had streaky white slips and were duochrome. Polychromes, with red matte paint, appeared to be restricted to the earlier transitional Glaze E-F vessels.

About 30 percent of the sherds assigned to Glaze F pottery were from the Abó area. Since only those sherds that could be positively classified as Kotyití Glaze-polychrome, Glaze-red, or Glaze-yellow are included here, the decrease in percentage of Glaze F trade from Abó may reflect ceramic typing methods rather than an actual trade decrease at this time. The Glaze E rim forms, as in Jornada, Trenequel, or Puaray, may have persisted for a longer period of time at Abó before the Glaze F rim forms came into style.

At Gran Quivira 11 percent of the Glaze F sherds with Abó temper were white-slipped, corresponding to 12 percent of Glaze F sherds from Abó. Glaze-red vessels predominated in the trade from Abó, although matte red designs were also present in the Glaze F material.

Gran Quivira produced about 2 percent of the Glaze F pottery found at Mound 7.

Salinas Red Ware

The plain, undecorated red wares at Gran Quivira are, in part, locally made, with the balance obtained either from Abó or Quarai. The general similarity of temper in the Glaze F and Salinas types confirms the suggestions of Toulouse (1949) that Salinas Red was produced by Glaze F potters. However, it is a curious circumstance that red wares produced at Gran Quivira constituted 34 percent of the total Salinas Red ware sherds, while less than 5 percent of the glazes of the same period were local. In addition to the possibility of classification errors, the inconsistency might be explained by the preference of Mound 7 residents for glaze decorated wares, which would make imports of red wares correspondingly lower. Since Salinas Red ware made up less than 1 percent of the total sherds from Mound 7, it was apparently of little importance to its residents. Furthermore, since Salinas Red ware was popular at the mission at Abó (Toulouse, 1949) and at the *convento* at Quarai (Hayes, 1980), it would be interesting to know if the Spanish occupants of the mission at Gran Quivira preferred Tabirá Plain in the same forms.

Chupadero Black-on-White

The Chupadero Black-on-White pottery at Gran Quivira contained a fairly consistent temper material composed of varying amounts of calcite, shale or clay pellets, and quartz sand. Occasionally small amounts of crushed sherd, igneous rock, or iron oxide grains were present. A minor temper type, found in less than 10 percent of the Chupadero sherds, was a fine-grained quartz mica schist. The latter may have been traded in from elsewhere, but the site of manufacture is not known. The temper resembles that of much of the corrugated ware from Mound 7.

A crushed vitrified sherd temper, found in the majority of Chupadero sherds from Pueblo Colorado, was found in a number of Chupadero Black-on-white sherds from Gran Quivira, but these were not tabulated separately.

Since over 90 percent of the Chupadero sherds at Gran Quivira contained the calcite-shale temper, these were probably of local origin. Occasional fragments of local biotite felsite supports this conclusion.

Tabirá Ware

About 95 percent of the Tabirá sherds from Gran Quivira contained biotite felsite temper, a rock that crops out locally in a sill. The clay used seems to be identical to that of the Chupadero wares. The Tabirá sherds often contained minor amounts of calcite and clay pellets, similar to those of the Chupadero sherds. Tabirá sherds from Pueblo Blanco had a similar temper, but with more calcite and clay pellets.

Tabirá Polychrome vessels were decorated with yellow and red ocher, which was apparently applied after firing. The pigments are powdery and dull, always lap over the black paint designs, and are fugitive. When heated, the yellow-orange (10 YR 7/6) and dark yellow-orange (10 YR 6/6) turn a dark red-brown (10 R 3/4). Lighter reddish brown (10 R 5/4) shades will also turn dark red-brown when heated. The pigments used were probably limonite, jarosite, and hematite in powdered or earthly form.

The black paint of the Tabirá wares ranges in color from dark-brown and reddish brown to black. In the sherds that were tested, the constituents were magnetite and other iron oxides. The paint was probably applied before firing and is generally not fugitive. One fragmentary vessel of Tabirá Polychrome, however, had fugitive black paint, possibly due to underfiring. Portions of the vessel had yellow and red pigment, and the vessel may have broken before the decorations were completed.

Culinary Wares

The earlier culinary wares at Gran Quivira, characterized by corrugated or ribbed exterior surfaces, were tempered mainly with a quartz mica schist, which contained coarse angular grains of quartz, as well as fragments of silvery or brownish black mica in a fine-grained quartz matrix. Although the source of this temper material is not known, it may have been found near the site. About 25 percent of the earlier culinary wares contained coarse angular grains of quartz and white feldspar with small amounts of biotite, while approximately 10 percent contained the local biotite felsite temper.

The late culinary wares were tempered mainly with biotite felsite (74 percent), with a smaller percentage (20 percent) containing coarse quartz and white feldspar grains similar to those in the corrugated wares. The latter may have been intrusive to the site, but the source is not known.

Pottery at Quarai

By A.D. 1629, the mission at Quarai was established, although the pueblo itself may have been occupied 10 or 20 years earlier. An early black-on-white site with some Glaze A is present at Quarai. Pottery of a second occupation site includes some late Glaze E, but mainly Glaze F. A total of 380 sherds from the second, or late, occupation were available for examination. The Glaze E sherds were all late or transitional Glaze E–F types.

Of 112 rim sherds of Glaze F, 76.7 percent contained hornblende gneiss temper, an indication that these wares were indigenous to the site. The majority of glaze decorated sherds had red surfaces that were smoothed and polished, but apparently unslipped. A large proportion of the glazes had streaky white slips. The few polychrome sherds were confined to the late Glaze E or transitional Glaze E–F types.

Trade ware from the Zia area, the Santo Domingo Valley, San Pedro Pueblo (?), and the Galisteo Basin were present at Quarai. Nearly 10 percent of the glaze decorated wares containing the hornblende syenite temper were from, Abó Pueblo, or from that vicinity.

Overall Glaze

Fragments of an *olla* or pitcher with an overall glaze containing a rhyolite tuff temper were found at Quarai, and are probably from a Cochití village. Similar overall glaze vessels have been found at a 17-th century site (LA:591) across the river from present-day Cochití (Warren, Ms. a). The exterior of the Quarai vessel was apparently covered with a well-vitrified pale green to brown glaze, while a thin, transparent, light-green glaze slip had been applied to at least part of the interior.

Salinas Red Ware

Hornblende schist temper was found in 99 percent of the Salinas Red ware sherds from Quarai. Similarities of temper and clay in both glazes and red wares strengthen the belief that both types were made by glaze potters. This relationship has been noted at other 17-th century sites, including LA:295, 591, and 34 in the Cochití area and LA:3137 at San Felipe, at Pecos, and at San Marcos in the Galisteo Basin (Warren, Ms. b). The absence of instrusive Salinas Red wares, compared with more than 20 percent intrusive glaze wares, suggests that the former was not a popular trade item at Quarai. However, Salinas Red ware made at Quarai was found at Gran Quivira in minute quantities.

Plain Red "Brick" Ware

The 123 sherds of "brick" ware examined suggest completely different ceramic traditions from the Salinas Red wares. The coarse red wares were first named and described by Toulouse (1949) from material found at Abó. The brick ware was also designated "Manzano Coarse Ware" by Hurt and Dick (1946), and as "Carnué Plain" by Dick (1968). Eighty-seven percent of the brick wares contained either a coarse sandstone or siltstone temper, or a combination of both. The remainder were tempered with hornblende schist or some other type of metamorphic rock.

Sixteen percent of the brick wares were decorated with red paint. These correspond to Casitas Red-on-brown (Dick, 1968) or Manzano Thin Red-on-buff (Hurt and Dick, 1946). The decorated sherds tended to have a finer grained temper than the coarse undecorated wares. Occasional thin white slips or wash were found on sherds. Surface polishing was sometimes noted, but generally the exterior of the brick wares was rough, while the interiors were smoothed, polished, or burnished. The clay matrix was orange-red and friable.

The Salinas Red ware from Quarai contained only schist temper. If the brick ware was contemporary with Salinas, it was most certainly not produced by the potters who made glazes.

A few sherds of brick ware, presumably intrusive, were found at Mound 7, Gran Quivira, although these were not checked for temper. Brick ware may have been produced in Spanish households before the Pueblo Rebellion of 1680; however, sporadic reoccupations of the mission sites after that date could account for its presence.

Culinary Ware

Of the 51 Corona Plain sherds from Quarai, 86.3 percent contained a calcareous sandstone temper that was distinct from the sandstone used in brick wares. The Corona Plain vessels were probably contemporary with the Glaze F occupation and produced by glaze potters. On occasion, glaze potters used the same temper material in the utility ware as in the glaze decorated and plain polished red wares, but as a rule they used a different temper type.

Pottery at Abó

The majority of the glaze and culinary wares from Abó available for examination were from the late Glaze E and F periods, due to a scarcity of surface sherds on the earlier sectors of the site. Additional information concerning the glaze wares of Abó was obtained from trade ware sherds at Gran Quivira and other nearby sites.

The high percentage (89 percent) of glazes tempered with hornblende syenite and the finding of rock samples at Abó make it almost certain that this temper type was used there. Possibly other glaze villages in the area, LA:200 and 592, were also producing pottery with this temper material, although sherds from these sites were not examined.

From the description given by Shepard (1942) of "soda diorite" in the Jornada and Salinas districts, this is the syenite of Abó. The Abó syenite also corresponds to the Class I temper of glaze decorated wares as described by Vivian (1964).

Potters at Abó were making Glaze A wares with hornblende syenite temper including Los Padillas Glaze-polychrome, since small amounts of these early wares have been found at Gran Quivira and other sites in the vicinity, signifiying that trade had begun early. No appreciable indication of trade was noted until Glaze C times, however.

From Glaze C through Glaze F periods, Abó was apparently the main source of glaze-decorated ware in the Salinas area. The Abó glazes are characterized by red surfaces, either duochrome or polychrome. Only one sherd in eight (about 12.5 percent) had a white slip. The red wares appear to be unslipped, although the surface finish is the same as on slipped pottery.

The majority of culinary ware sherds (Corona Plain) contained angular grains of quartz and feldspar with some mica. The Abó hornblende syenite, however, was used to a limited extent in the culinary pottery.

Salinas Red Ware

An even higher percentage (91 percent) of syenite temper occurred in the Salinas Red ware than in the glazes. As suggested by Toulouse (1949), the red ware was undoubtedly made by the Abó glaze potters with forms similar to those of the contemporary Glaze F vessels. In addition, there was a high incidence of soup plate forms.

Chupadero and Tabirá Wares

The few Chupadero and Tabirá Black-on-white and Tabirá Plain sherds from Abó contained tempering materials believed to be indigenous to Gran Quivira.

Pottery at Tajique

Although only a limited number of sherds from Tajique (LA:381), a village north of Quarai, were available for study, the general patterns follow those of other sites in the area in regard to trade ware.

Glaze A pottery was mainly from the Los Lunas area and contained vesicular basalt temper. Glaze-yellow wares came from the Galisteo area. Most of the late glaze sherds were tempered with the hornblende gneiss of Quarai, but appreciable numbers contained the Abó-syenite.

A few sherds of glaze decorated and Salinas wares were found to be tempered with crushed sandstone. This might possibly be an indication of local manufacture, since sandstone is rarely found as temper in the Salinas area. However, more study would be needed to determine the source of the sandstone tempered glazes.

Pottery at Pueblo Colorado

A total of 89 sherds from Pueblo Colorado were available for examination, 67 of which were Glaze A to E sherds. Trade patterns are similar to those at Gran Quivira, with Glaze A red pottery coming from the Los Lunas area, and sherd temper occurring in about half of the early glazes. Cieneguilla and Largo Glaze-yellow sherds came from the Galisteo villages, while Glazes C, D, and E were either from Abó or Tonque. No local temper type appeared to be present.

Chupadero Ware

Most of the Chupadero sherds were tempered with crushed vitrified sherd which ranged in color from lavender-gray to black. Also present were dull, unvitrified, angular fragments of crushed sherd with fine quartz grains. The clay matrix contained moderate amounts of fine (0.1 to 0.25 mm.) subrounded grains of quartz. The quartz was usually colorless, but a few pinkish grains were noted. Rarely were fresh transparent vitreous feldspar crystals present. The clay containing this temper type is light to medium gray in color, finely granular, and compact. A few sherds with the Gran Quivira temper type were also present.

Pottery at Pueblo Blanco (Tabirá)

Pueblo Blanco—a site contemporary with Gran Quivira—has a ceramic assemblage that very much resembles that of Gran Quivira. A total of 231 sherds collected from the surface were examined, including 141 mainly Glaze E and F sherds. A few glaze decorated sherds (about 3 percent) with sandstone temper might possibly be of local manufacture. The only other site in the Salinas area where sandstone tempered glaze was found was Tajique. As at Gran Quivira, Glaze E and F sherds were either from Abó or Quarai.

A few Glaze A sherds were of the Los Lunas or Pottery Mound type, while the early glaze-yellow wares were from Galisteo villages. The middle glaze sherds had temper characteristic of both Abó and Tonque pueblos. Salinas Red came from Abó and Quarai.

Tabirá Wares

The temper and clay of the Tabirá Black-on-white and Polychrome at Pueblo Blanco are identical to those of Gran Quivira. Geologic references do not indicate any of the igneous intrusive rocks near Pueblo Blanco, such as those providing the biotite felsite temper of Gran Quivira. It is possible, of course, that both villages produced Tabirá wares using the same temper and clay; more likely, though, the Tabirá wares at Pueblo Blanco had been made at Gran Quivira.

Chupadero Wares

Two temper types were found in the Chupadero Black-on-white sherds at Pueblo Blanco. One is predominant at Pueblo Colorado, a crushed vitrified sherd temper. The other is the temper found in a majority of Chupadero sherds at Gran Quivira.

Summary and Conclusions

Chupadero Black-on-white vessels were produced at Gran Quivira, and traded to other areas, throughout the period of occupation of Mound 7. After A.D. 1600, Tabirá Black-on-white and Polychrome wares were made at Gran Quivira, and traded to a limited extent to nearby villages in the Salinas area.

During the early glaze period, most of the glaze-decorated pottery at Gran Quivira and other Salinas pueblos was imported from ceramic centers in the Middle Rio Grande Valley. After A.D. 1400, Abó Pueblo became a production center, supplying neighboring villages with glaze pottery. Sometime after A.D. 1600, Quarai was settled and began production of glaze vessels for trade.

After the Spanish missions were built in the early 1600's, Abó and Quarai potters supplied undecorated wares, Salinas Red, to the Spanish. Forms included soup plates, candlesticks, chalices, and other altar furnishings. Tabirá Plain vessels made at Gran Quivira in the 17th century were also produced for mission use. Seventeenth century pottery found at sites on the eastern High Plains indicates trade between the Salinas villages and the Plains Indians. Gran Quivira may have served as a distribution center for other Salinas pueblos.

Production and trade of pottery in the Salinas pueblos ceased around A.D. 1675, when crop failures and enemy raids led to the abandonment of the entire district.

Resettlement of the area by Spanish colonists in the 18th century was followed by production of late historic pottery, such as the "brickwares," and polished black and red pottery by Mexican potters, who were either settlers or servants in Spanish households.

7. Human Skeletal Material

Erik K. Reed

Introduction

Large quantities of human skeletal material have been collected at Las Humanas over a period of more than 100 years. In a report on one of the earliest recorded Anglo-American visits, in 1853, we find, "Near the east end of the chapel [San Isidro] we saw where the people who had been digging [for the famous but imaginary 'Gran Quivira' treasure] had thrown up a great many human bones which now lie scattered about. From these we have selected six skulls to send to someone who is skilled in the science of craniology" (Carleton, 1854, p. 314). What became of these specimens is not known.

Then, in an article on "the Ruins of Gran Quivira," published in 1898, John W. Virgin mentioned finding, in a "slight excavation in one of the house mounds near the church," two human skeletons, one adult and one child. Probably there have been other such finds, totally unrecorded.

In the School of American Research excavations of 1923-1925 in the pueblo ruins, on land within the Monument then owned by the state of New Mexico, a sizable number of burials were found: in 1923 alone, 39 were uncovered in three test trenches at the north side of the pueblo, and seven more in a trash mound on the west side of the main plaza and large kiva, which Hayes identified as his "Area I" between Room 3 and Kiva K at Mound 7 where he found seven more burials. Finally, in 1925, at least nine scattered skeletons, including five infants, were recovered in the same area (Hewette, 1923, p. 81; unpublished field notes, National Park Service files). The human skeletons from this work were deposited by Dr. Hewett at the San Diego Museum of Man and were still there before, and possibly after, World War II. However, after one of the changes in directorship of the institution a number of years ago, this collection could not be located.

In the course of the stabilization and cleanup work during 1956, human burials were encountered in the *campo santo*, a rectangle 53 by 83 feet in front of the smaller church, San Isidro, enclosed by a limestone masonry wall 18 inches wide:

> When we began work on the campo santo area, I presumed that it had once been leveled, and we dug several trenches in an attempt to locate the occupational surface. We could not identify one. There were remnants of a prehistoric room in the approximate center of the area. Aside from this, our exploratory trenches disclosed only the location of several burials.
>
> There were random and fragmentary human bones throughout most of the fill in the camp santo. These represented interments disturbed during the construction of the chapel and the camp santo wall, and probably other pre-Spanish burials disturbed while the campo santo was in use. In the north center of the area, at a depth of less than a foot, was a group of three complete and three fragmentary human skulls which probably represented a reburial made during the construction period. There was one pre-Spanish burial beneath the remains of the small aboriginal room; it was an adult, flexed on its back, and without grave offerings.
>
> Along the west wall of the campo santo was a mass of human bone. It appeared to be a mass burial made in a trench lengthwise of the wall. Some individuals were in the position of articulation and others were represented by random bones, particularly skulls. This group was within a foot of the surface and was exposed during trenching to clear the wall for stabilization. It was necessary to remove some of the bones, but no attempt was made to establish the extent of the mass grave. It was estimated that from 12 to 15 individuals were exposed. If the grave extended any distance from the wall it could easily have held three or four times that number. They may have represented people who died in the famine of 1666-68 (Vivian, 1964, p. 80).

The petition of Fray Francisco de Ayeta, the *custodio* of New Mexico, of 10 May 1679 reported on the famine of 1668: "There were pueblos, as instance Humanas, where more than 450 died of hunger" (Hackett, 1937, p. 302). This was not long before the abandonment of Las Humanas and other Piro villages and missions of the Salinas district in about 1672.

In the 1951 work on the church itself, the ruins stabilization crew had found two subfloor burials just within the entrance of San Isidro, one on each side, both extended at full length on the back and undoubtedly dated from the mission period (Vivian, 1964, p. 80). Presumably Christian, these remains were re-interred.

The excavation of Mound 7 by Alden Hayes (1980) from 1965 to 1967 yielded 149 cremation burials and 361 unburned inhumations—154 of them infants, 58 children between 4 and 17 years old, and 149 adults, including several between 18 and 21 years of age. In addition, about 3,000 miscellaneous, scattered human bones—for the most part scraps and fragments—were collected.

Finally, as the Mound 7 project was being completed in October 1967, three fairly well-preserved skeletons that were being exposed or disturbed by erosion in the campo santo were brought in; in addition, a half-dozen more specimens in this category—two quite good adult skeletons, a damaged adult cranium, and fragmentary remnants of at least one infant—were collected by area personnel in July 1968, and have also been covered in this study.

No report of the human skeletal material recovered at Las Humanas has ever, as far as I know, been published previously, nor has any from other sites in the vicinity or the entire Salinas province. The only other such ruin at which intensive excavations have been carried out is Pueblo Pardo, 3 miles south just across the valley from Las Humanas (Toulouse and Stephenson, 1960). The skeletal remains from 25 inhumations (7 adults, 3 sub-adults, and

15 infants) that Toulouse and Stephenson found in 1941 were studied in 1962, and my report on them is included here, only slightly revised since 1963.

There is also one specimen collected in 1959 by Stanley A. Stubbs at the ruins of Tabirá (LA:51, Pueblo Blanco, cf. Stubbs, 1959), a child of seven to nine years, which I examined and have referred to, because of its extreme occipital deformation, in a later section.

Otherwise, there has not been any skeletal material published from anywhere in this area in the geographical center of New Mexico, except for a couple of fragmentary skulls from LA:2945, Gallo Arroyo, Lincoln County (Reed, 1957).

Skeletons from the "Smokey Bear" site in Lincoln County, north of Capitan Mountain, which I examined for the University of New Mexico in 1966 and 1967, will be mentioned later in connection with type and affiliations of Las Humanas material.

To the southeast, the only specimens on record from southeastern New Mexico are a female adult skull from the Peñasco Bend site, LA:2000 (Neumann, 1940), and 10 crania from the Guadalupe Mountains (K. Bartlett, in Mera, 1938), plus my unpublished notes on a skeleton from the Texas Technical College excavations at the Bonnell site.

And from northeastern New Mexico, east of Pecos Pueblo, there is only one find in print, so far as I know—a skeleton from the Cimarron River area, without cultural associations, originally thought by Roberts (1937) to be very ancient.

The northwestern quarter of New Mexico and the upper Rio Grande, above Belen or Isleta, are comparatively well known archeologically; a good deal of human skeletal material has been studied, and much of it published. The southernmost example in this category would be one from salvage excavations at LA: 2567, on the Rio Puerco west of Belen (Reed, 1956), which could well be regarded as in central New Mexico, but which I have considered an Anasazi specimen and have grouped with upper San Juan-upper Rio Grande material.

In the southwestern quarter of New Mexico, much archeological work has been done, and several very small skeletal collections or single specimens have been studied—for example, a few of the many inhumation burials found in the Swarts Ruin on the Mimbres River (Howells, in Cosgrove and Cosgrove, 1932), a female skull from Mogollon 1:14 (comments by George Woodbury in Haury, 1936a), some material from the Starkweather site (Nesbitt, 1938), a small Highway Salvage collection in the upper Tularosa River, Apache Creek (Reed, 1957), a brief general statement on skulls from the SU site (Marjorie Kelly, in P.S. Martin, 1940, 1943), and an as-yet-unpublished report on 23 burials from the Joyce Well site in the southwesternmost portion of the state (Reed, Ms. e).

All the preceding specimens noted are from the Mimbres and Gila river drainages; there is nothing from the Jornada del Muerto, the Rio Grande valley between the El Paso area and the Belen vicinity (except for one skeleton from Socorro, lacking associations, but at least surely Indian, which I have examined at the Museum of New Mexico), the Plains of San Agustin and the North Plains, or the upper Little Colorado south of Hawikuh.

In the remainder of this section are my study of the burials found in Mound 7, Las Humanas; my report on the material collected by Gordon Vivian in the 1956 work on the campo santo of San Isidro, with a statement appended on the skeletons collected there in 1967 and 1968; my notes on a small amount of skeletal material found in pithouse excavations on the monument area in 1964; my report on the skeletal material from Pueblo Pardo across the valley; and finally, general topics relating to these collections (life span, artificial cranial deformation, pathological or anomalous features, and racial types).

Burials from the Excavation of Mound 7

In the first season of excavation (the summer of 1965) in the large ruined pueblo structure labeled "Mound 7" at Las Humanas, Gran Quivira National Monument, 106 burials were recovered, including 31 cremations. In addition, about 575 scattered human bones were found, including at least 5 infant skulls, partial or nearly complete. Aside from these crania, it is not possible to state how many additional individuals the bones from the general diggings represent, because I cannot determine with any certainty which ones are portions of incomplete burials already listed. The great majority of these bones consists of (1) hand, foot, and ankle bones, plus a few patellae, and (2) scraps and fragments, partial shafts of long bones, and broken ribs.

The second season of excavation in Mound 7 at Las Humanas yielded 228 additional burials, 53 of them being cremations. About 1,900 "miscellaneous" human bones were collected in the 1966 campaign, of which over 1,000 are scraps and fragments that are not included in the figures given in the rest of the discussion. For the balance of this group a minimum faunal count can be offered, but I do not believe it really means much.

The most abundant single bones for adults (including any larger juveniles) is the right ankle bone (the talus or astragalus)—14 were uncovered at Mound 7, as opposed to only 8 left. Otherwise, the maximum quantities of individual mature bones are only 11 left femora (6 male, 2 female, and 3 uncertain), 11 right first metatarsals, 9 mandibles, and 9 right innominates (4 male, 4 female, and on uncertain). But I feel that the more than 550 scattered bones, even though a number of them are likely strayed from listed burials, represent more than just a dozen individuals. In addition, there are over 170 bones of small infants, representing at least a dozen individuals, and probably many more. In the listing of fragments of crania, for example, 30 means not a mere 30 separate bones, but 30 occurrences of partial baby crania in several or numerous pieces. There are 14 mandibles up to age five or thereabouts.

Approximately 140 bones of larger children up to subadult include not over 4 or 5 of any one item, but again I believe a larger number of separate individuals is present. The group includes much of a 14-year-old (in PS-5604), parts of a 15-to-17-year-old male (FS-5603), several bones, plus the left innominate from FS-5526), as least two 9-year-olds (a cranium and a pair of femora in FS-5707, plus paired femora and numerous other bones in FS-5795), at least one 6-to-8-year-old (the ribs, vertebrae, and right humerus in FS-6033), and at least two 10-to-11-year-olds (a left humerus and various other bones in FS-3516, and a left humerus and a few other bones in FS-4761).

In the third and last season (May-September 1967), 176 additional burials were found—#335 through #510—of which 65 were cremations. The miscellaneous human bones recovered in this final season totaled approximately 450 (plus an undetermined number of scraps and fragments in with bones of other animal species being studied at Gila Pueblo). In the 1967 material, a number of items of special interest were encountered among the scattered bones, and undoubtedly a large number of individuals other than the numbered burials are represented. There are however, only comparatively few specimens which I can be fairly sure about, including at least three adults, three infants, and a child between 12 and 17.

The scattered miscellaneous human bones from the 1967 work, consisting largely (as in previous excavation season) of rib fragments and bones of the hands and feet and various infant bones, included seven complete essentially undamaged adult or sub-adult long bones. These exemplify the futility of attempting to place the miscellaneous bones as coming in part from numbered burials found —many of which are incomplete or disturbed and partial—and then determining a minimum faunal count on the balance. Among the 1967 season's bones are: (1) a left fibula (FS-9481) 382 mm. long (cat. no. Q/4434/37), which exceeded all fibulae in length in the burials, the males ranging only from 335 to 371 mm.; (2) a sub-adult fibula, lacking both epiphyses (hence under 17) but 310 mm. long, which does not correspond to any of the few skeletons between 12 and 18 years of age (FS-10998); (3) a left forearm, carpus, and hand, the ulna 224 mm. long and the radius 204 mm. long —these are exceptionally small and do not fit precisely any gap in the series (FS-10910); (4) a right radius 244 mm. long with nothing distinctive, not precisely matching any lack among the measured burials (FS-10302); (5) a pathological right femur, 394 mm. in bicondylar length (cat. no. Q/4435), a left femur 404 mm. long, and another left about the same size, too much damaged for measurement—neither of the left femora, however, have suitable opening in the series (FS-7790).

A partial explanation of the situation is found in the high probability that a large number of burials remain in the unexcavated portions of the deeper part of the ruin. Several are known to exist beneath walls of the later construction and are not easily recoverable. In fact, Alden Hayes (personal communication) thinks that there may be almost as many skeletons still buried as he brought in.

Certain of the "miscellaneous" finds particularly suggest a disturbance of the burials, with disappearance (so far as we are concerned) of most of the bones. In lot FS-10910, mentioned above, the left ulna and radius are accompanied by 7 of the 8 left carpals (lacking the cuneiform), the 5 left metacarpals, and 16 phalanges and 2 of the right carpals—so that this is *not* just a left forearm and hand tossed aside—plus a right first rib, a left patella, and a tarsal (the right cuboid), all of a proper size to accompany the ulna and radius.

And then lot FS-10053 consists of a number of well-preserved small pieces of a juvenile around 15 years old (*not* missing from #487); they are exactly those bits that might be left behind in the removal of such a skeleton: epiphyses of long bones (and of scapula and calcaneum), carpals, tarsals, metacarpals, metatarsals, phalanges, one vertebra, and a few teeth.

Of the total of 510 burials found in the work on Mound 7, 149 had been cremated, and the calcined or heavily charred fragments of bones gathered up and buried in small pits, not in pots (except in one instance, #472). Twenty-two of the 84 cremation burials found in 1965 and 1966 were infants or very small children, and 54 were adults, adolescents, or larger children (over, say, about 6 years old), plus 8 quite uncertain. Finer division of the cremated material into specific age groups did not seem possible. Being unable to do much with the 1965-1966 specimens, I did not even look at the 65 additional cremations from the third season.

One hundred and fifty-seven of the inhumations unburned were small infants (fetal or premature through about 3 to 4 years old), while 55 fell between four and 17 or 18 years old, and 149 were adults, including several between 18 and 21. A more detailed breakdown of age groups for the unburned inhumations is given in Table 32, and the subject of life expectancy is discussed separately in a later section. Adding the minimum figures on the miscellaneous bones would raise these totals to 175 to 200 infants, 80 or 90 larger immature specimens, and 160 to 175 adults.

Among these there are approximately 115 usable adult skeletons. At least some observations were made on 115 crania (49 male, 66 female) and 115 mandibles (not all the same individuals); 65 of the crania (29 male, 36 female) and 65 mandibles could be measured (again, some of these are from different individuals). Observations were noted on at least portions of 124 skeletons, aside from the skull, which encompassed 112 partial or complete sets of measurable long bones. (I classified 45 male and 67 female, including several rather questionable assignments, as is also true of the skulls, the specimens for which I was particularly uncertain as to sex were also those on which only a very few items were recorded.)

Of the total of 149 individuals over 18 years of age, 55 are identified fairly positively as males, and 4 are listed as probably male; 80 are definitely females, and 8 more are thought to be; 2 in especially poor condition could not be sexed even tentatively.

Except for material discarded as too fragmentary to be worth keeping, the burials recovered in the excavation of Mound 7 have been deposited on indefinite loan at Arizona State University in Tempe, where Christy Turner II has examined them. Along with some of his advanced students, Turner will make specialized investigations on various topics, particularly aspects of the dentition. He has already made fairly specific determinations of age, and occasionally of sex, on many cremation burials. From the 1966 season, for example, Turner identified 20 cremations as follows: three infants (up to 3 years old), one sub-adult, four young adults (21 to 35 years of age), four middle-aged adults, and eight adults of unspecified age. Of 64 cremations from the final season, Turner listed 4 as infants, 8 as children (4 to 12 years old), and 37 as adults—14 young adults, 4 middle-aged adults, and 2 recognizably male nad 4 female—with 13 unidentified and 2 non-human.

On skeletons from inhumation burials, Turner and I are generally in very close agreement on age determinations, enough so that I am not making any revisions or additions in this connection, and we have a fairly high degree of correspondence on sexing. There are six adults on which we diverge, as well as juvenile #211; for this specimen I had noted, with some hesitation, "probably male"; according to Turner, however this is a female.

In my notes on two of the adults, #118 and 175, considerable uncertainty as to sex is manifested, with conflicting indication from different criteria; no reservations or hesitations appear in connection with the other four. I had listed as male or probably male #188, 262, and 329, but in Turner's judgment these are females. Again, I have #175, 193, and 233 as females, while Turner finds them to be males. Otherwise, we agree on all the adult skeletons examined by Turner. I am gratified by the fact that our divergences are 50 percent each way, aside from the 15-year-old, which indicates that I do not consistently make some particular error (which presumably would be suggested if the reversals were all one way).

Final pages added on Tables 36 and 37 give revised means and ranges of long-bone measurements, with #262 and 329 as females and #175, 193, and 235 as males (no measurements could be recorded for #118, a fragmentary and incomplete specimen).

This was not done for Tables 33 and 34, however, because the differences in the means produced by these shifts are negligible—as much as only one point in the cranial index (in others, only a few tenths) in the males, and only in the mean orbital index in the females (and five- to six-tenths in vault length, basion-bregma height, and biogonial width of the females).

Several changes, however, are produced in the ranges given in Table 33. With #262 out, the lower extreme of the male range for maximum length of the cranial vault becomes 161 mm. instead of 156 mm., and the upper end of the range of the cranial index is 85.96 mm. instead of 94.02 mm. (and the mean becomes 77.25 mm.—or 77.4 mm. with questionable figures included—without #262 and 329; for none of the three being transferred in the other direction could sufficiently accurate measurements be taken to calculate this index dependably). Without #262 the upper end of the range of the total facial index becomes 93 mm. instead of 94.69 mm.; the lower end of the range for the bigonial diameter is 89 mm. instead of 88 mm., while that of the bicondylar diameter of the mandible is 108 mm. instead of 109 mm. when #193 is included.

Quite a few changes are brought about in the female ranges of cranial measurements (none, however, on the mandibles). In Table 34, the largest vault length becomes 182 mm. instead of 177 mm., with #193 included; without #235, the largest bizygomatic width height is 76 mm. instead of 79 mm., the top of the range of the nasal height becomes 52 mm. instead of 54 mm., the lowest nasal index is 46.1 mm. instead of 42.6 mm., and the highest right orbit is 41 mm. instead of 42 mm.

Inclusion of #262 in Table 34 extends the range of maximum cranial breadth to 147 mm. (instead of 146 mm.), of the cranial index to 94.02 mm. (instead of 88.9 mm.), and of the total facial index to 94.69 mm. (instead of 92.2 mm.). With #235 deleted and with #262 and 329 included as females, the mean of the orbital index becomes 90.7 mm.

Comparatively few of the skeletons found at Mound 7 are in an excellent condition of preservations, and quite a number are good or fairly good. Many, however, are in very bad shape, decayed and fragmentary. Such wide variation in the condition of preservation and completeness—from extremely bad to virtually perfect—suggests wide differences in taphonomic history, from death and burial to discovery; it was unexpected, considering that all these specimens came from the same archeological context, in or near a single structure (except #26, from the Late Phase trash in Test Trench 1). But conditions within the fill of the building varied considerably, with some of the burials deep and under floors, others in trash-filled rooms, and some in areas outside but adjoining the ruin.

Occipital Deformation

There are 204 crania, immature (but past neonate size) and adult, in a condition permitting determination as to artificial cranial deformation. In a number of cases this is uncertain—in fact, scarcely more than a tentative opinion—either because of incompleteness of the specimen, or owing to post-mortem distortion, or because I simply could not decide firmly on certain specimens with irregularly slightly flattened areas of the occiput (actually, placed higher on the back of the skull, usually about or above lambda).

Of these 204 crania, 110 are definitely undeformed, and 34 more are thought to be, with some degree of uncertainty. Any deformation, other than a perfectly natural lambdoid flattening, of any of these is very slight, incidental, and quite accidental, and is scarcely to be classified with more definite (and possibly intentional) cradleboard effects typical of Pueblo skulls.

The other 60 crania from the Mound 7 burials are listed as deformed in some degree, but again several are uncertain—"very slight if any," or "ill-defined, not flat"; in other words there are irregular areas that look decidedly unnatural. Only one specimen, infant #108, has true vertical occipital deformation in pronounced degree; several others are moderately deformed, while a few are deformed vertically, but only lightly. A dozen other crania are flattened at the "lambdoid" angle (50° to 60° from the Frankfort horizontal, which runs from the lower edge of the orbit through the top of the earhole), but only slightly to moderately. None show the powerful compression (a sharply delimited flat or concave area) of the true lambdoid cranial deformation that is distinctively characteristic of San Juan Anasazi and also present in the upper Rio Grande area (Reed, 1949).

The great majority of the 60 deformed skulls are flattened at an intermediate angle, oblique but almost vertical, or else between that and typical lambdoid, say 70°–80° from the Frankfort plane. In some cases, the deformation, although surely unnatural, is very slight and rather irregular or poorly defined. Of 41 crania classified in the intermediate category, 21 are listed as "very slight" or "slight," and 15 as "moderate"; only 5 are "pronounced" in degree. In several of the latter two groups, the flattening is asymmetrical, with six cases showing slightly greater compression on the right side, and four showing it on the left side. Marked asymmetry of lambdoidal deformation is common in the Chaco-Puerco-Mesa Verde region, although not in the Kayenta district, where assymetry is frequent but less characteristic, with vertical occipital deformation.

Twenty-three of the crania involved are from the Early Phase, or the first construction period—the concentric circles building underlying the main structure of Glaze A times (or early Pueblo IV, falling in the 14th and 15th centuries). Only four of these are definitely undeformed, five less certainly so. The other 14 show artificially produced flattening at an oblique angle—2 lambdoid (one slight, one moderate with no asymmetry), 4 at an intermediate angle approaching the lambdoid (3 moderate of which 2 are asymmetrical, and one pronounced), 7 at a truly intermediate angle (3 very slight, 3 moderate, one pronounced, with the pronounced specimens and one of the moderate specimens showing a markedly greater compression on the right), and one of undeterminable exact degree and type. None are vertical or close to vertical. Four of a half-dozen skulls that may also be from the Early period are deformed at an intermediate angle, in degree from very slight to pronounced, and two are probably undeformed.

Fifty-nine of the 91 skulls that are assigned with some assurance to the Late Phase (correlating approximately with Glazes E and F in the 16th and 17th centuries) are undeformed, and 12 others are thought to be, but somewhat uncertainly. Three are slightly flattened—seemingly artificially—at a lambdoid angle. The 14 deformed vertically, or almost so, or at an intermediate angle, range in degree from pronounced (one) through moderate (7) and slight (4) to very slight (2). On two of these and on one "lambdoid," the flattening is poorly defined and irregular. There are a half-dozen on which deformation is quite uncertain.

Thirty-four skulls are from burials positively assigned to the Middle Phase, an intermediate stage in the architectural history of the pueblo that probably corresponds to Glazes C and D and perhaps early Glaze E (in the late 15th century and early to middle 16th), and 23 more are probably or uncertainly from this horizon. These and a group that are either Middle or Late show quite similar patterns, giving a combined breakdown for the total of 79 crania of 42 undeformed, 14 probably undeformed, 4 deformed lambdoidally, 4 deformed vertically, and 15 at on interdemediate angle.

Although there is not as clear a correlation as might be desired, there does appear to be a definite trend from predominantly deformed in the Early Phase to about 75 percent undeformed in the Late Phase, which revealed only a few specimens with pronounced or even moderately strong deformation. The significance of this change is a matter of cultural history, not physical anthropology, but it presumably could well be correlated with any other changes in the population of Las Humanas from the original settlement to the 17th century that are discerned in the osteological study. The subject will be discussed further in a later section, in combination with other material from the vicinity and in comparison to material from other districts.

Details of Adult Crania

General shape (outline in the *norma verticalis*): ovoid or between ovoid and pentagonoid whenever not distorted by artificial deformation. Parietal bosses are generally not well developed.

Saggital elevation: conspicuous on several crania of the Late Phase, but not accompanied by median frontal cresting (cf. later discussion of Pueblo Pardo material).

Sutural complexity: low or sub-medium in 9 males and 20 females; moderate in the lambdoid suture (but low in other sutures) in 19 males and 23 females. As in most San Juan Anasazi the lambdoid suture is rather intricately serrate in only 5 males (including #118, 119, 212, and 437) and 13 females (#50, 158, 162, 169, 208, 213, 254, 267, 268, 291, 389, 419, and 477). In three males, #149, 260, and 333, complexity is low in the lambdoid suture, but moderately high in others.

There is one case of persistence of the metopic or mediofrontal suture into adult life, female #248 (age 27 to 33), a topic that receives extended special discussion in a later section. And there is one even more unusual item that is also discussed later: on male cranium #333, one squamous suture has disappeared, and the left parietal and temporal are completely united. Finally, in female #401, the left half of the lambdoid suture has been largely obliterated prematurely.

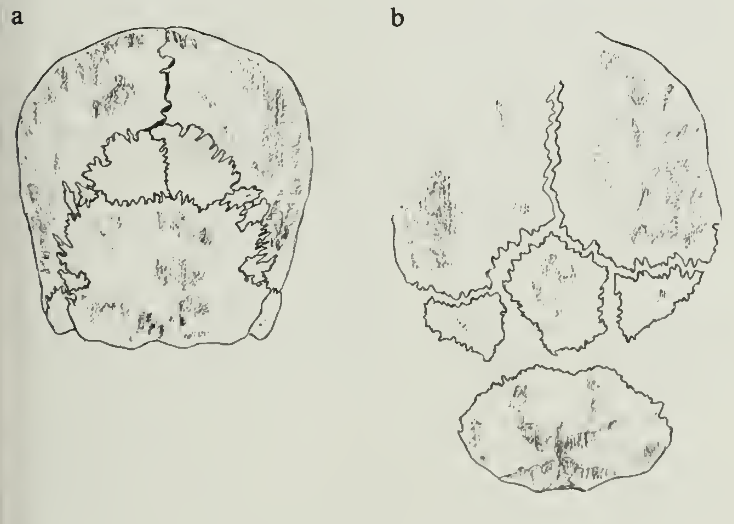
Wormian bones: none in most cases where certainty is possible (at least 35); a few small ones in the lambdoid suture in males #18, 171 (juvenile), 262, 264, 460, and, probably, 41, and in 16 of the females and several infants. Male #256 and females #65, 418, and 428 have Wormian bones in the occipito-temporal suture, but none in the lambdoid. Male #437 has one just above the asterion on the left side; female #409 has one in the saggital suture at obelion.

Five males and five females have a greater development of this trait. Males #212, 292, 391, 460, and 491 and females #208, 268, 389, 419, and 477 have several or numerous Wormian bones near lambda. Male #491 also has a small apical bone *above* lambda. Female #165 has a Wormian bone at lambda, but no others. The specimen with metopism, #248, also has numerous Wormian bones, in the lambdoid suture and in the occipito-temporal areas.

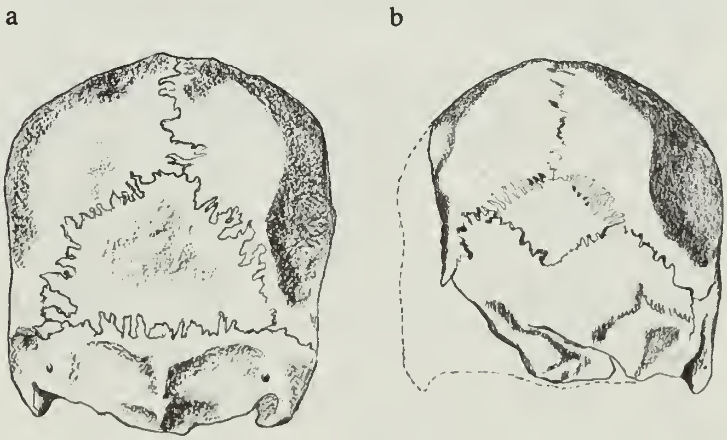
Finally, male #150 has a symmetrical diamond-shaped lambda bone that can be referred to as an example of *os inca* rather than a Wormian bone (see later discussion in the final section of this report), male #508 has a smaller *os inca*, and there are two young children with divided Inca bones; #489, about 7 years old, has a bipartite one, and #480, about 3½ years old, has a tripartite one.

Neither of these children show a "genuine" interparietal, divided at the asterion level, but they nevertheless could qualify, on the basis of size and symmetry, as *os inca* or divided occipital rather than simply Wormian bones at or on either side of lambda; the division on #480, in fact, is only slightly above the asterion level (see fig. 56). There is, however, an example of a true interparietal bone, the occipital divided from asterion to asterion (fig. 57), from the campo santo (see discussion of Burial A, below).

Occipital torus: an indistinct low mound, slightly to moderately developed, usually not well defined, with no]protrusion at inion–except elderly male #17 (a strong ridge), middle-aged males #119, 143, and 217 (distinct, fairly strong mound), younger male #149 (moderate mound with a distinct external inion), male #281



56. Crania of #489 and #480.



57. Crania of Burial A and #150.

(strong but low mound with a remarkably developed tab-shaped inion process), male #333 (a small distinct external inion tab), male #391 (like #281), and male #437 (again with a distinct external inion tab), and females #51, 56, 76, 168, 237, 243, 392, 410, 419, and 466 (all with a low mound somewhat larger and more sharply defined than the rest) and #163 and 291 (both with small external inion).

Mastoid processes: small in most males, although fairly large in a dozen specimens; generally quite small or very small in females, but rather large (for a female) in a few.

Supremastoid ridges: in most cases small, only slightly developed, and not well defined; a few exceptions–strongly marked in males #17, 21, 59, and 210, and females #34, 62, and 237, and fairly so in a half-dozen additional each of males and females.

Pterion: a normal H-arrangement in almost all cases, narrow to moderately wide; see discussion in the final section of this report.

Frontal bone: most often a low or moderately low, small, narrow forehead, with little or no development of frontal bosses; forehead listed as high, however, in 5 males (#109, 119, 145, 149, and 212) and in 10 females (#34, 50, 56, 123, 158, 168, 193, 208, 282, and 291), and as moderate in a number of others.

Supraorbital foramina or notches: the series is divided almost evenly between a pair of small foramina, a pair of notches, or one of each, with no significant difference between the sexes.

Glabellar prominence: very slight or none in 15 males (but this includes #118, 262, and 329) and in 43 females; slight in 11 males and 6 females (but this includes #193 and 235); moderate in 10 males and 6 females (strong for a female; #165, 175 [actually a male, according to Turner], 243, 401, 410 [sex not certain], and 417); and pronounced on 9 males (#17, 21, 59, 121, 207, 256, 281, 333, and 458).

Brow ridges: absent, or a mere trace, in 10 males and 50 females; very small in 9 males and 19 females; small or medium on 16 males and at least one female (#243, listed as female by both Turner and me), and in #175 (large and prominent for a female, if #175 is of that sex after all); and strongly developed in males #207, 256, 265, 333, 458, and 497. The number of males with very small brow ridges, or only a slight trace, or none, is reduced from 19 and 18, and the number of females in these categories increased to 70 by Turner's review of the sexing (#118, 262, and 329 as females, #193 and 235 as males, all of which fall in these lowest brackets).

Nasion depression: simulated on males #17, 59, and 333 by the prominent glabellar area; in male #21, there is "genuine" depression of nasion relative to the frontal bone and the position of the orbits.

Nasal profile: in males predominantly concavo-convex and prominent, but generally not as highly arched as is typical in most San Juan Anasazi material; in females the nasalia are short, relatively broad, and concave in most cases, with about one-third concavo-convex. In about half of the concave female profiles and in a good many males, there is a slight convexity at the tip.

Nasal overgrowth: only a few instances, listed as very slight or slight in six males (#14, 17, 391, 436, 497, and 508) and in 13 females, with slight "undergrowth" in males #59 and 149 and in females #76, 169, and 417.

Nasal spine: small to moderate in most; strong in males #59, 149, 171, 207, and 210; fairly well developed for Southwestern Indian females in #34, 50, 163, 243, and 295; and large in female #65 and in specimen #175 (male according to Turner, originally listed as female).

Orbit shape: generally rhomboid, or "rounded square"; varying from roundish to almost oblong in both sexes.

Orbit slope: slight to moderate in most; pronounced in males #17, 207, and 344, and in females #158, 243, 407, 428, and 466; none in males #212, 256, and 508, or in females #62, 152, 168, 213, 214, 248, 262, and 268, with horizontal orbits. In a few instances (males #391 and 437, female #419), the inclination is greater on one side.

Malars: small to medium size in males, and small in females; generally fairly prominent in both.

Suborbital fossae: most often slightly concave, moderately so in 13 males and 16 females; flat in 5 males (#14, 59, 171, 217, and 344), 2 females (#392 and 419), and 2 specimens listed as males by me but determined by Turner to be female (#262, and 329); quite deeply excavated in 2 males (#207 and 333) and 6 females (#136, 142, 162, 208, 243, and 466). Occasionally there is a noticeable difference between the two sides.

Alveolar prognathism: slight to moderate and generally greater in females, as is typical for Southwestern material.

Minor special features: There is a particularly large postcondylar foramen on only the right side of the skull base of #389, which has a button osteoma just above and to the right of lambda. The right occipital condyle of #419 is divided into a double oval (as is the corresponding articular surface of the atlas), and there is an unusual foramen in the upper surface or "base" of the zygomatic process of the right temporal that is not on the left. As will be discussed later, females #163 and 214 have precondylar tubercles.

Dentition and Mandibles

In general the male mandibles are fairly large and strong, as are some of the female mandibles. Several females have a rather masculine angle between the ascending ramus and the body instead of a sloping ramus. Typically the male chin is fairly square and prominent, but of median type in several instances (e.g., #275); most often it is bilateral or medio-bilateral. Exceptions–a prominent but not square chin–include #18, 26, 59, 230, 264, 270, and 375. In females, the chin is rather small and not very prominent, and is generally of median type, although fairly often medio-bilateral; in #419, it is prominent, square, and bilateral.

Eversion of the gonial angles is absent, or very slight in degree, for 12 males and 14 females; moderate (definite but not very pronounced) in 10 males and 2 females (#158 and 325); and rather pronounced in specimen #235. Occurrences of the mandibular torus were recognized: male #341 and an adult mandible, probably male, among the miscellaneous bones (specimen Q/4436).

The condyles of the mandible of mature female #389 have slight growths–like thin plates, not exostoses at the edges–with the right condyle splayed out and much larger than the left. Skeleton #389 shows a number of other possibly arthritic developments.

Since details of teeth have received specialized study at Arizona State University (see parts 12 and 15), only brief general statements will be offered here. Tooth wear is moderate on young adults, fairly to moderately severe on most of the adult specimens, and extreme on a few older individuals. Shoveled incisors are clearly recognizable in many cases, youthful to mature. Pre-mortem losses are frequent in the older individuals, but quite a few adults had suffered none at all. The losses noted are primarily of molars (four or more gone in either upper or lower jaw in many cases), frequently also premolars, and occasionally one or two incisors. Male #375 had lost all his teeth, upper and lower, with complete resorption. The incidence of caries is moderately frequent. Large cavities and abcesses of molars are noted for quite a number of individuals, although less often in premolars, and only occasionally in front teeth.

A supernumerary tooth in female #163 is above the left central incisor in the left maxilla under the nose. Supernumerary incisors more normally located are noted for two females, #213 and 254. There is a supernumerary (?) tooth in the palate of 3-year-old #502. Mature male #355 has only three lower incisors, as does 17-year-old #486.

Another dental condition present in this collection is crowding, with third molars occasionally impacted, mainly in females. The upper right M3 is impacted in female #50 and in male #497; in female #65, only the upper left M3 has erupted, and crowding of the teeth has pushed the upper right canine out in front of the incisors, and the lower left outer incisor behind the central and incisor and the canine. Female #417 and male #437, both young adults (the former specifically between the ages of 21 and 24), have the upper M3's impacted, in both cases with the left one turned backward (in #427 the right upper has not emerged); in both, the lower M3's have not erupted, and there is, in fact, no room for them. The mandible of mature female #445 (whose cranium is missing) has no third molars and evidently never did. And it is quite possible, of course, that a number of the older specimens with extensive tooth loss and most or all molars gone had never had third molars.

Crowding of lower incisors is noted for a number of specimens, most of them female, with a couple of instances of a canine or incisor twisted in its socket. In female #419 (near age 27), in which the M3's may never have erupted, the upper teeth are crowded, and the left upper second premolar is rotated 90°, with an exceptional degree of inward twist or "winging" of the upper central incisors. The upper right central incisor of #394 is peculiarly deformed.

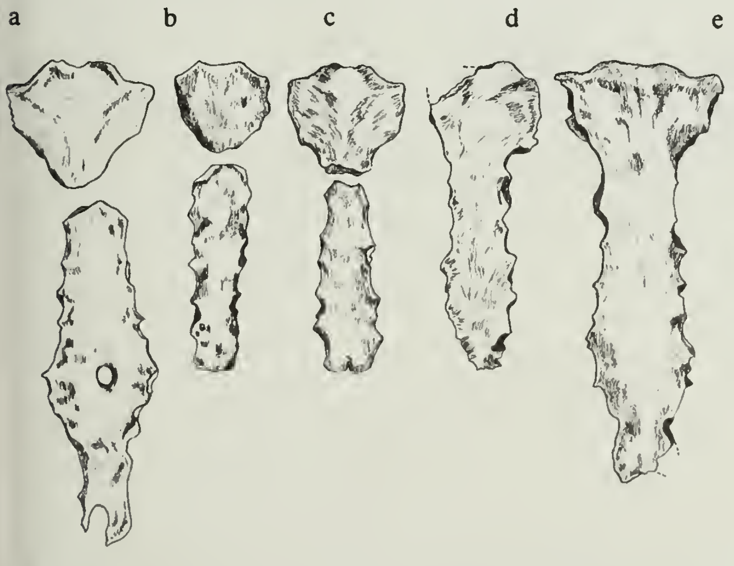
Of interest among the miscellaneous human remains not specifically associated with the numbered individual burials from the first season is the occurrence on a "miscellaneous" lower incisor of a lingual ridge, the *tuberculum dentale* (a bud or cusp or bulb on the inner surface), a somewhat uncommon trait. The specimen has been deposited in the comparative collection on skeletal pathology and anomalies at the University of Utah. In the 1966 collection, a generally similar but distinctly bigger lingual ridge was noted on an upper incisor of 27-year-old female #320, and a small one in #169. Male #497 has an enameloma or bud on the upper left third molar. In a few cases (e.g., #404, and the right but not the left of #418), the upper first premolars have two separate roots, which I believe is normal in many (or most?) groups; here, the majority of all premolars do not show definite bifurcation or actual divergence of the roots.

Post-Cranial Skeleton

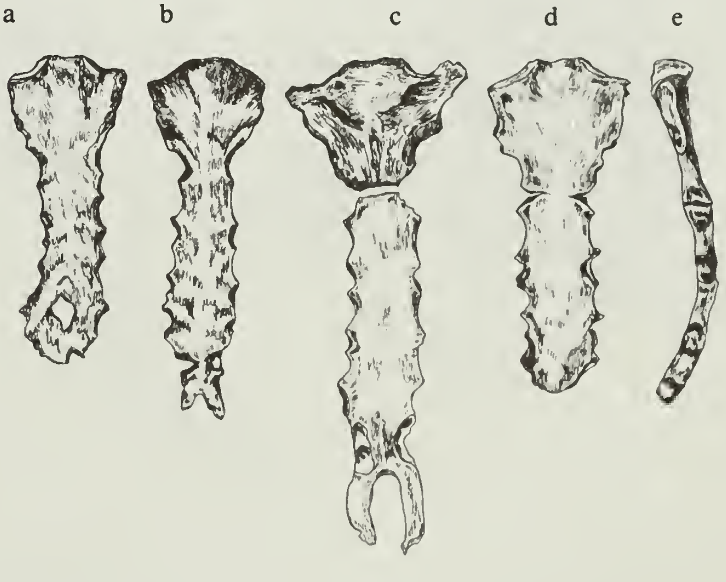
The sternum is quite variable in shape and size (see figs. 58 and 59), frequently with the manubrium separate, even when the xiphoid (ensiform) is ossified and united with the gladiolus. In 100 adults with observable gladioli (37 male, 63 female), there are eight instances of a sternal foramen—males #256 and 344, and females #62, 79, 163, 196, 198, and 468 (see special discussion in final section). The two gladioli among the miscellaneous bones are unperforated.

The shoulder blades and collarbones are of interest primarily in connection with aging and sexing, and the collarbone is particularly valuable for the claviculo-humeral index as an indication of build. Many female clavicles are very slender, and those of #275 are remarkably slender for a male.

In female #65, the peculiar development of the coracoid process of the right scapula correlates with the unusual deficiency in the head of the right humerus. The excessive lipping of the rim of the glenoid fossa of the right scapula of mature male #375 probably should be labeled osteophytosis rather than must the normal glenoid lipping that develops with advancing age. In the left (but not the right) scapula of #462, the suprascapular notch is made a foramen by an "extra" strip of bone (fig. 60a). And in the left scapula of mature female #477, there is a partial briding of the notch (fig. 60b), while the right scapula of #477 has no distinct suprascapular notch.



58. Variations of the sternum.

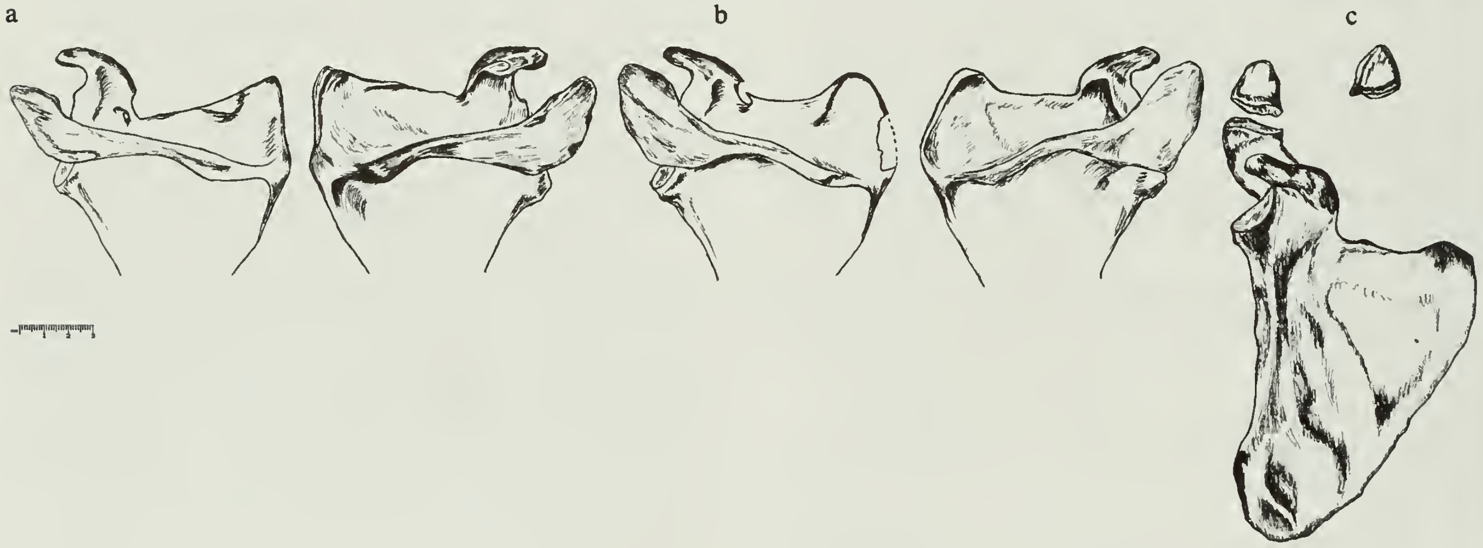


59. Variations of the sternum.

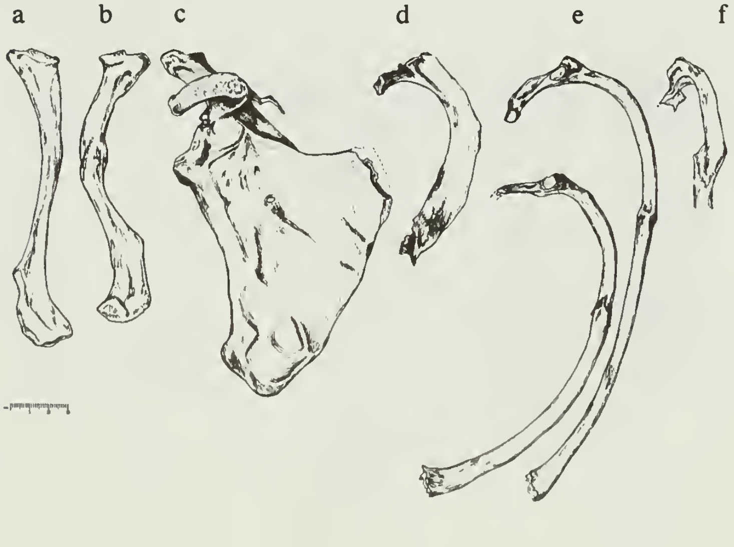
The end of the acromion process of the right scapula of young adult female #419 had failed to unite, and the epiphysis is present but separate (fig. 60c). The right scapula of adult male #491 has a peculiar outgrowth depending from the coracoid process, presumably as part of the response to the injury that broke the right clavicle (which healed with considerable offset) and at least three ribs on the right side (fig. 61). Male #41 also has a badly broken and poorly healed right clavicle and healed fracture of three ribs; in this case, however, no involvement of the scapula was noted.

In many instances, the sternal ends of the first ribs, and less often others, bear exostoses that are evidently ossified cartilage. In one, #175, the right first rib is thereby united to the sternum (as was the left, now broken off). A similar condition is present in a Pueblo IV specimen from LA:586 in Tijeras Canyon. I have not observed this (presumably missing any specimens well enough preserved to have been noted) in other material I have examined, but a more extreme and unmissable instance of this kind of phenomenon is a specimen from LA:3638 near Correo, New Mexico, with coastal cartilages completely ossified and solidly joined to the sternum.

In addition to the rib fractures mentioned as accompanying broken clavicles, a broken (and healed) second rib is noted for male #256; a central rib in female #148 may be the same, with only very little offset. The right second rib of youthful adult female #419 has a large protrusion—a broad point—about halfway along. In a number of instances, the twelfth rib is exceptionally small, at least on one side. The right first rib of #163 (a mature female) is double-headed (see discussion in final section). A cervical rib occurs in #418 (fig. 62), and there must have been one with #404. This and certain other details of ribs will be mentioned in connection with certain vertebrae.



60. Variations in the scapula.



61. Various bones of #491 in connection with trauma in the area of the right shoulder.

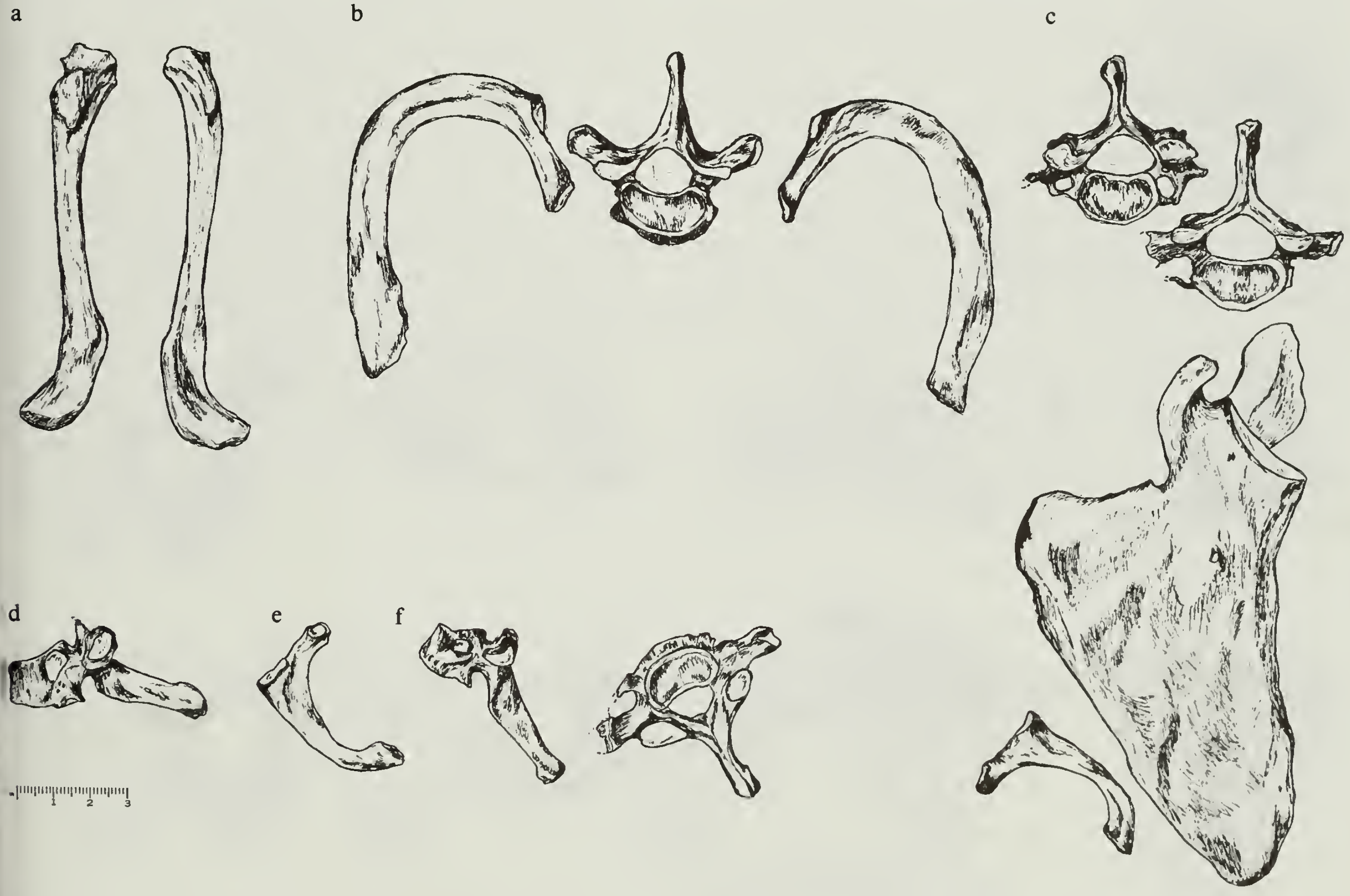
Osteophytosis of the spine–exostoses, possibly arthritic–is common, as is normal in the older individuals, primarily on the lumbar vertebrae. In some degree this is virtually universal in the specimens assessed as over 27 years old at death. Considerable growth on some or all of the lumbars, with a little on a few of the thoracics, is typical. Extreme cases are not infrequent (fig. 63).

Such exostoses and other special bone developments should not be labeled as osteoarthritis or other specific terms amounting to medical diagnosis. Instead, such noncommittal descriptive terms as osteophytosis (which simply means bony growth, not even–I think–implying a pathological condition) should be used, especially in descriptions by archeologists and physical anthropologists who do not have even basic general training as physicians. This has been pointed out by T. Dale Stewart, M.D., and others–and most clearly and effectively by Spencer L. Rogers (1966).

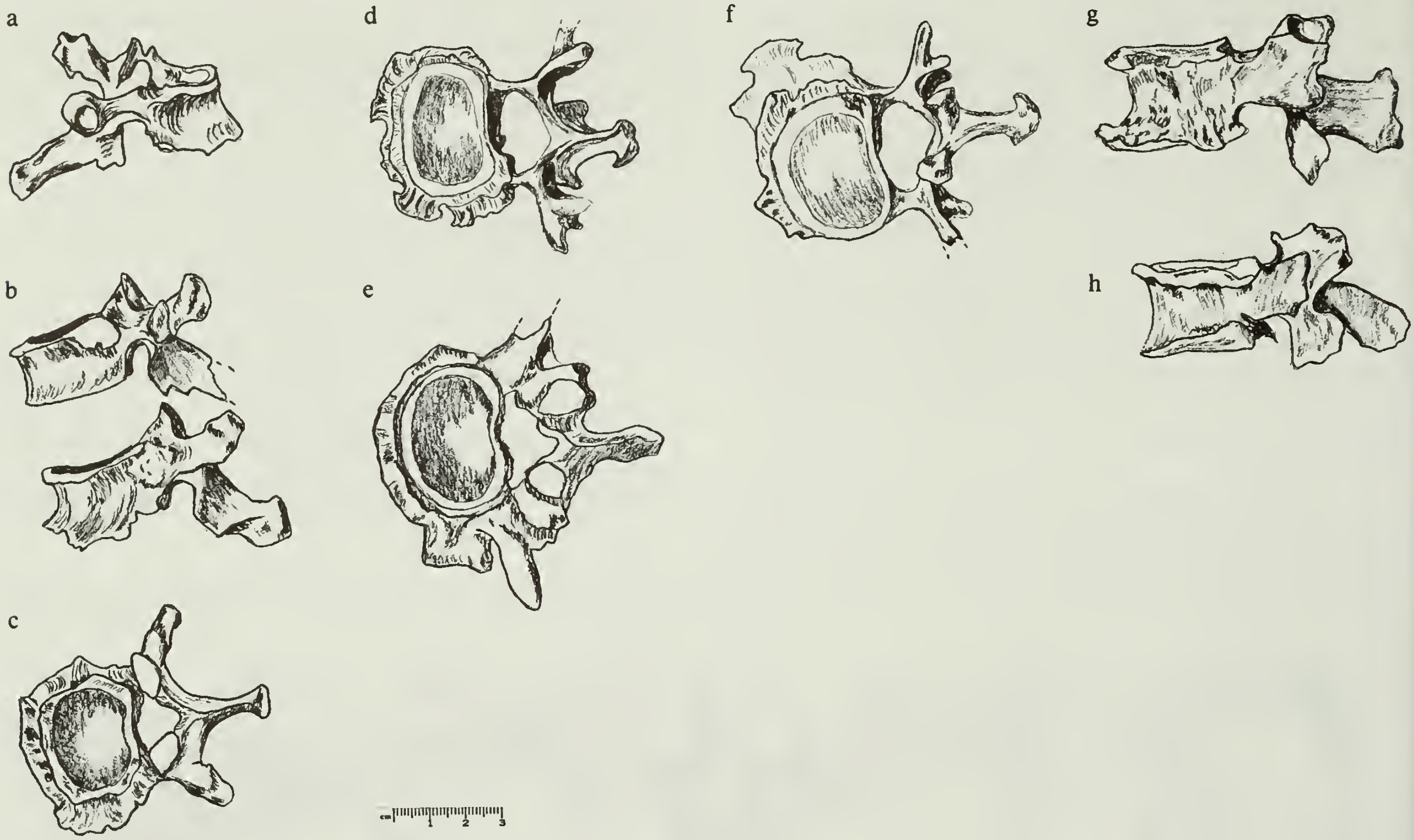
Other less usual features of the spine include several variations. In #262, the fifth and sixth cervicals are ankylosed. In youthful adult male #383 the axis and third cervical are united (fig. 54), a less uncommon occurrence (cf. Reed, 1967). In #409, two upper thoracics were evidently joined, without osteophytosis–only a fragment of the combined anterior surfaces remains. Female #65 has two of the thoracic vertebrae united. There are probably other cases of vertebral fusion which I missed owing to the condition of the material.

In male #11, the development of the left transverse process of the fifth lumbar indicates that the vertebra had been half-joined to the (missing) sacrum. In female #50, the neural arch of the fifth lumbar is detached, separate, and was never fused ("spondylosis"–cf. Snow, 1948, pp. 465 and 520), and articulates with facets on the vertebra proper and on the sacrum.

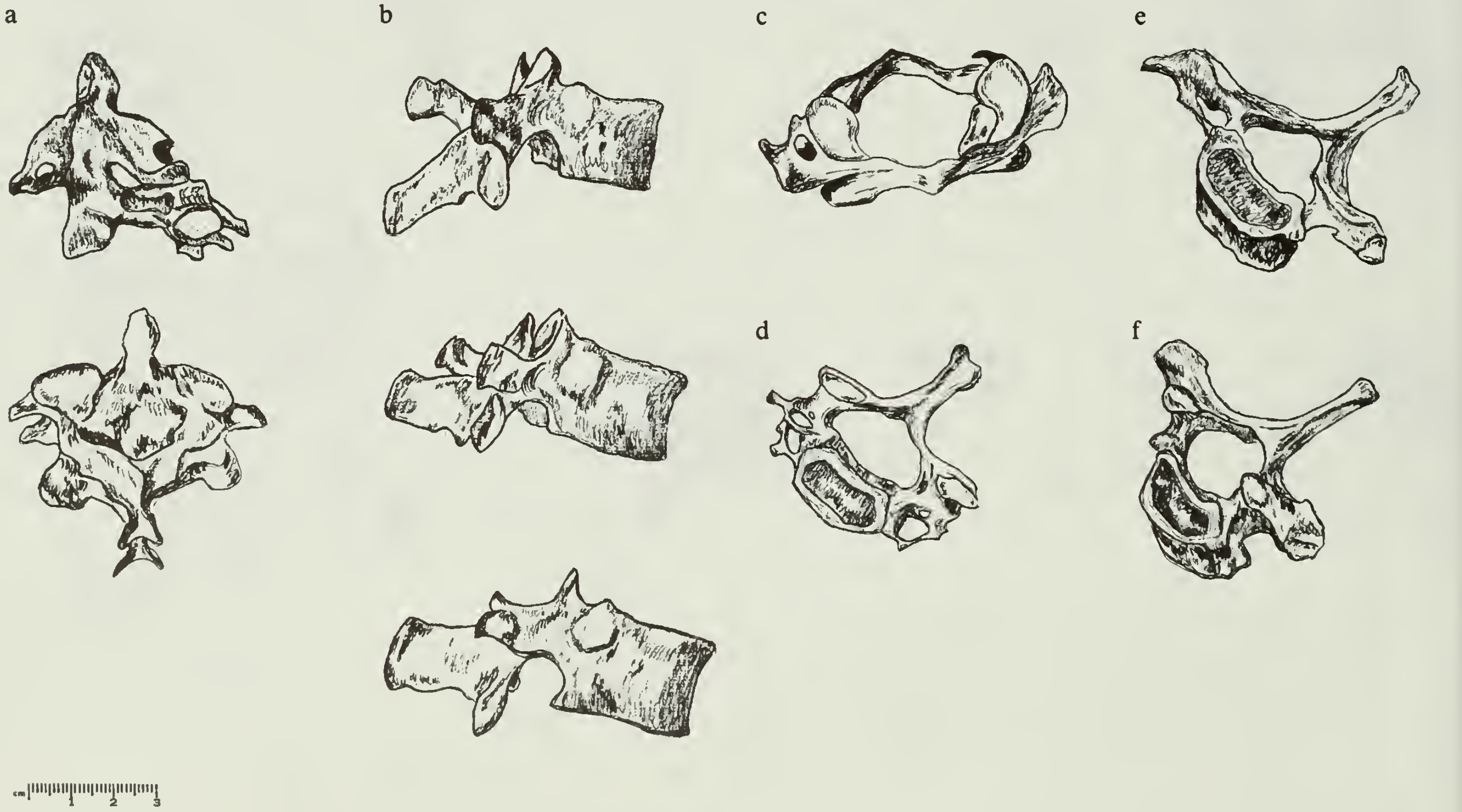
In male #149, there is a sixth lumbar vertebra, transitional to sacral in form (but with a normal five-segment sacrum) and with a detached neural arch. Female #428 has six lumbar vertebrae (the constitution of the sacrum, however, since it was damaged and fragmentary, is unknown). Two males, #161 and 260, and female #409



2. Bones of #418.



63. Burial 374, vertebrae with notable osteophytosis.



64. Unusual vertebrae.

have a "sixth lumbar" incorporated to form a six-segment sacrum (the coccyx separate). Females #3 (youthful, about age 18) and 165 have the fifth lumbar incorporated. Specimens #235 (male according to Turner) and 273 (female) have six lumbars and a four-segment sacrum, and #235 has a separate neural arch in the last two lumbar vertebrae. Among the miscellaneous bones, lot FS-4158 includes a six-segment sacrum with the last lumbar vertebra incorporated, but not completely joined on the left side.

The fifth lumbar of #169 has a divided spinous process, and the sacrum has a completely unfused spine, although with a wide opening posterior to only the first two segments and scarcely any gap from the level of the middle of the second segment through the level of the bottom of the third segment.

In 12 cases—males #120, 175, 288, and 460, and females #76, 126, 136, 152, 248, 289, 320, and 444—the first segment of the coccyx has fused with an otherwise five-segment sacrum (fig. 65).

These variations do not indicate a high incidence of such conditions in a Southwestern collection (cf. Reed, 1967), even though there are only 48 standard five-segment adult sacra definitely recognizable in the Mound 7 series, plus 6 more among the miscellaneous bones. This gives approximately 75 percent five-segment, 25 percent six-segment (almost 17 percent with coccyx incorporated, and six, or 8½ percent, with a sixth or fifth lumbar incorporated), aside from the two four-segment specimens.

A range of variations in cervical vertebrae is shown in Figure 66. On the seventh cervical vertebra of young adult female #404, on the left side only, the costal process is incomplete (fig. 64), and there are facets as for a rib on the body and on the transverse process, which is abnormally formed and short (and the right one seems unusually long). No extra or cervical rib is present, and the left first rib, regrettably, is not bicipital as in #163 (although it is larger than the right first rib, and has a larger articular facet). A cervical rib like that of #418 must have been lost along the way in the collecting process. The first thoracic vertebra is normal so far as the rib arrangements are concerned; there is a depressed area, an indentation that looks probably pre-mortem, on the right side of the body of the first thoracic just below and forward of the rib facet.

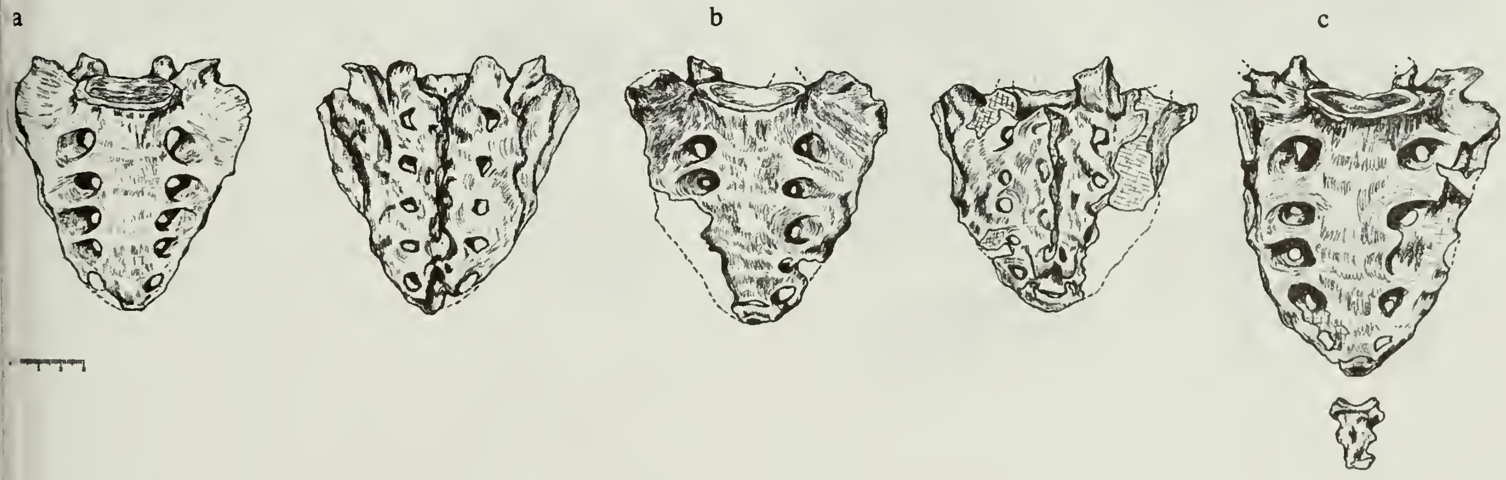
On the first cervical (the atlas) of #404, the transverse processes are exaggerated, especially the right, produced upward, and a pair of small points of bone extend back from the posterior ends of the superior articular surfaces, which along with condyles on the base of the skull, are normal. The other five cervical vertebrae appear to be normal. However, the tenth thoracic, like the eleventh and twelfth, lacks definite facets on the transverse process. Correspondingly, the tenth ribs lack the tuberosity.

The seventh cervical vertebra of #418 has facets on the left side corresponding to the cervical rib, which in this instance is actually present, and has a small osteophyte or extra process on the right side. The first ribs are exceptionally large, with the sternal end of the right one particularly wide; the second ribs are less unlike the lower ones than is usually the case. In #418, 462 (fig. 67), and 468, as in #404, the tenth thoracic vertebra lacks facets on the transverse process (as is normal in the eleventh and twelfth), and again the tenth ribs, as well as the eleventh and twelfth, lack the tuberosity. In female #419, the facets are quite indistinct on the transverse process of the tenth vertebra, and the tuberosities very small on the tenth ribs. In at least some of the well-preserved specimens, the tenth thoracic has the normal facets—for example, mature male #419, in which, however, the ninth thoracic has a small demi-facet below, and on both sides, as well as the normal, single, complete facet on the body.

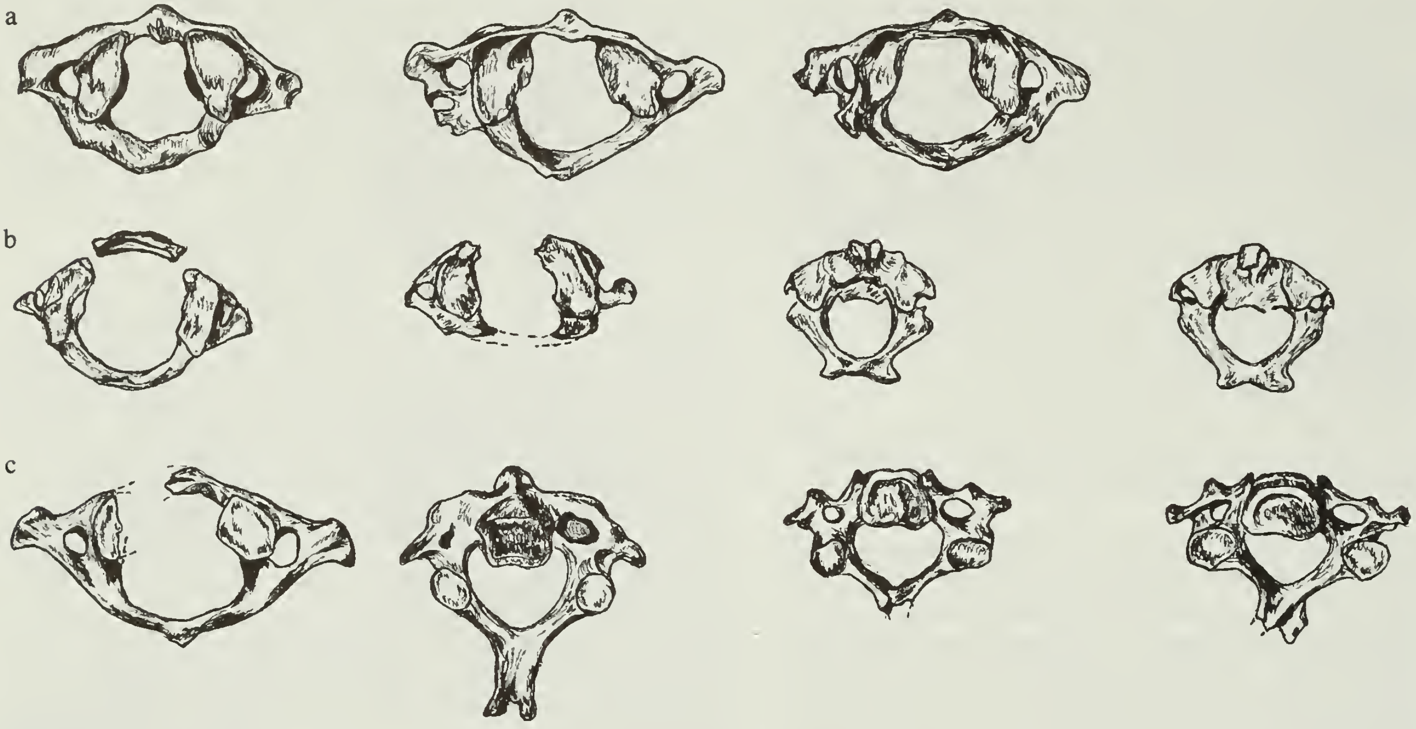
In mature adult male #344, the left superior articular process of the third lumbar vertebra is abnormally small. The left inferior articular process of the second lumbar is not reduced correspondibgly, but nevertheless articulates satisfactorily (see fig. 68).

Compressed lumbar or, less often, thoracic vertebrae occur (fig. 69). An extreme case is one lower thoracic of #409 (which has a true six-segment sacrum and a fused pair of thoracics); this is reduced from a height of 25 mm. at the back of the body to 8 mm. in the center of the front.

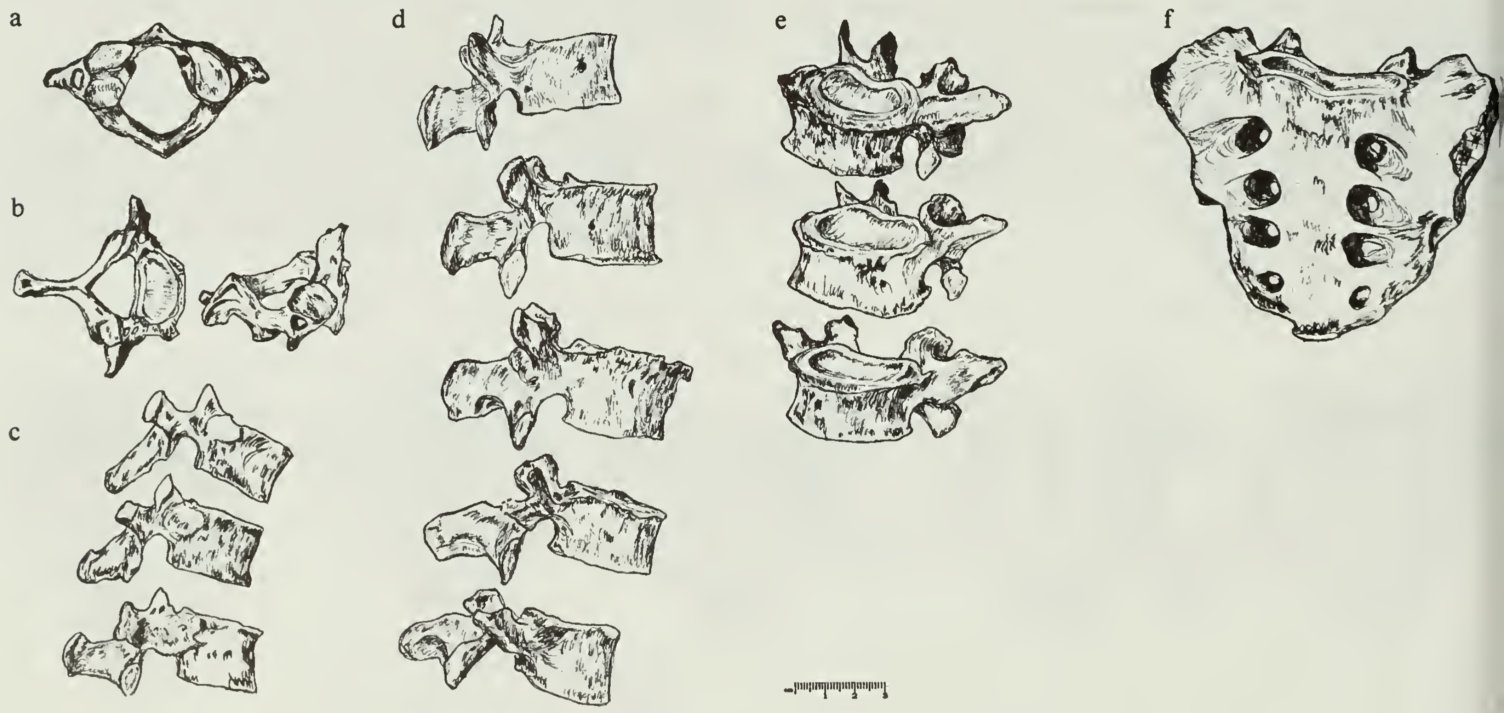
Male humeri are predominantly of moderate robusticity (those of eight individuals are listed as large and very muscular, nine as rather slender and of low muscularity), with slight, very slight, or no humeral torsion (no males were noted as decidedly twisted). Female humeri are preponderantly (75 percent) slender, but with strongly developed muscular attachments (19 "very mus-



6 . Forms of six-segment sacrum.



66. Variations in cervical vertebrae.



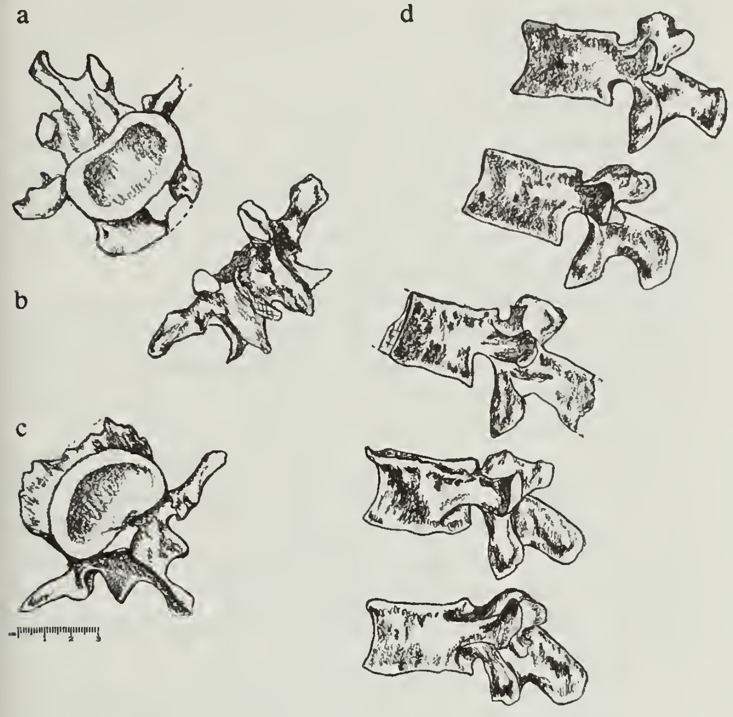
67. Bones of the axial skeleton.

cular," 25 "moderately," and only 6 listed as "slight development of muscle"), and with somewhat more humeral torsion on the whole.

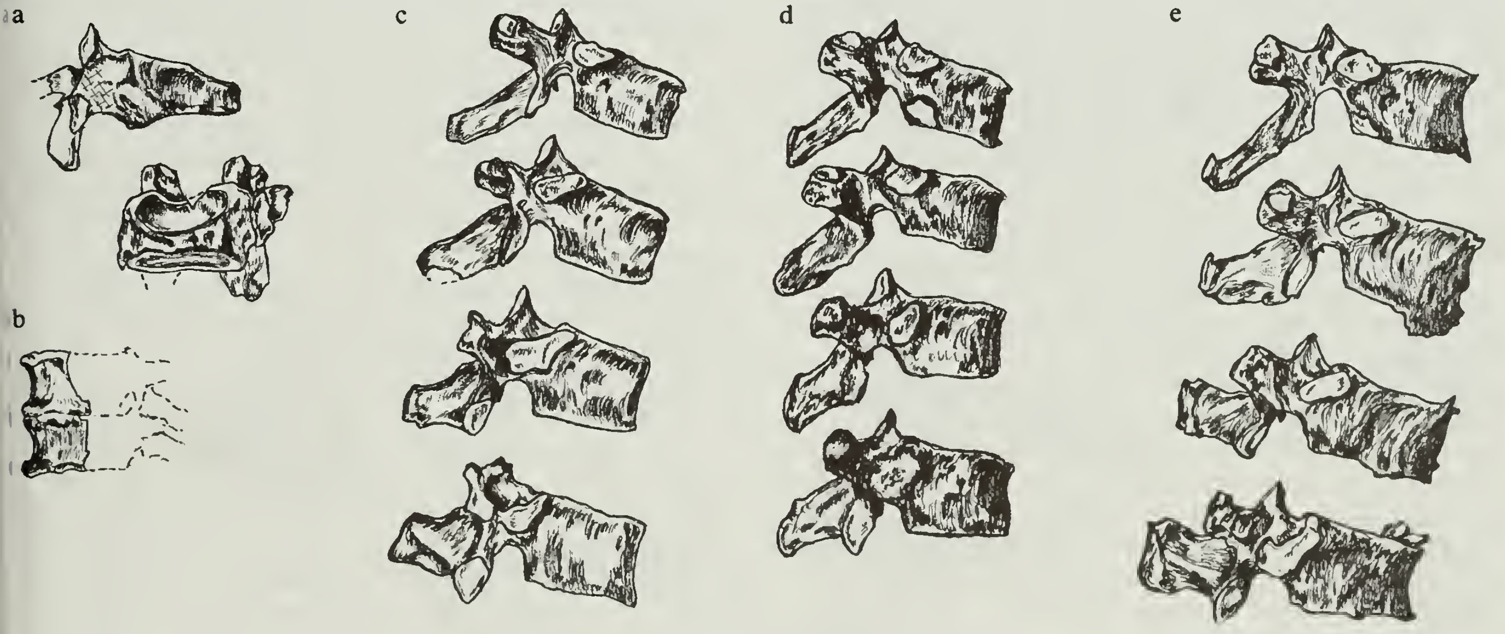
Among the miscellaneous bones from the Mound 7 excavations, there are quite a few adult humeri, seven of which could be measured—two of masculine size (diameter of each head, 42 mm., lengths, 300 and 310 mm.), and five in the female range (diameter of head, 37 to 38.5 mm., bicondylar length, 278 to 300 mm.)—plus a third male humerus, represented only by the large head, 48 mm. in diameter (almost the top of the range for the Mound 7 burials).

The size ranges of the Las Humanas humeri (the campo santo material described later falls within the Mound 7 ranges) for both the diameter of head and the bicondylar length appear unremarkable, except for the exceptionally short bones of tiny female #273 (no others fall below the Pecos range). The mean for the 5 Pardo males (see table 48) is almost identical to that of the 43 males from Mound 7 for the bicondylar length, but it is smaller for the diameter of the humeral head. The measurable Pardo females are of normal size.

The Las Humanas ranges are smaller, not surprisingly, than those in the much larger Pecos collection (134 males, 96 females: Hooton, 1930, p. 153). Data from Pecos are presented in Tables 38 and 39, together with figures available from Paako, 43 miles southwest of Pecos (S.L. Rogers, 1954), from three 14th-century sites in the Galisteo Basin, east of Pecos and north of Paako (Reed, Ms. a), and from three small typical Anasazi series from southeastern Utah (Brues, 1946a), southwesternmost Colorado



68. Burial 344, lumbar vertebrae.



9. Thoracic vertebrae.

(von Bonin, 1936), and the Puerco River area of northern Arizona (Stewart, 1940).

The means of the diameters of male and female humeral heads from Las Humanas (tables 36 and 37) are almost identical to those from Pecos (tables 38 and 39). As at Pecos and in the Galisteo Valley ruins (Reed, Ms. a), there is an overlap between male and female ranges from 37 to 44 mm., but actually there are very few male specimens under 42 mm. and extremely few females over 41 mm.

The means for humerus length are a few millimeters less than those published for the Pecos material, in large part because I have used physiological (bicondylar) length rather than maximum length. And I get less difference between right and left than Hooton found in the Pecos humeri.

In almost all of the Las Humanas males–41 of 43 from the Mound 7 observable on this point–there is no perforation of the septum between the olecranon and coronoid fossae. In several, however, it was impossible to determine this. In young male #452 small openings apparently are genuine rather than accidental post-mortem damage, and #207, a husky muscular adult male in the 38 to 42 years age group, has quite large septal apertures in both humeri.

Sixteen of 80 adult females show perforation of the humerus, at least on one side. In five instances, the aperture definitely occurs in only one humerus (the left in all cases: #50, 62, 162, 302, and 417). In eight (#61, 198, 291, 337, 400, 462, 466, and 468), both humeri are perforated–minutely in #61 and the right of #462, and quite large in #466 and 468. In three others, one humerus is present and perforated, but the other is missing (#176, 213 [a 19-year-old], and 254).

Among juveniles between 12 and 13 and 17 to 18 years of age, two listed as "probably male" (#211 and 271) and estimated at 15 to 16 years old have perforated humeri, with notable large apertures in #271. Juvenile #487 has a large opening in the left and a tiny perforation in the right. Three other probable males at age 15 to 17 (#171, 276, and 486) have unperforated humeri, as does probable female 13-year-old #287. Additionally, the right humerus of a juvenile (between 13 and 17 years old, probably a 15- to 16-year-old female) from lot FS-3617 among the miscellaneous bones has a large aperture comparable to that of #271.

An incidence of 20 percent in adult females is not a high figure for Southwestern Indian material, and 3 percent for adult males would be quite low. Including the juveniles listed above, stipulated as correctly sexed, would not greatly change the female percentage, but it would raise the figure for males to 8½ percent, which matches that for the male right humerus at Pecos (but for the left side at Pecos, 16 percent: Hooton, 1930, p. 155). However, a number of the adult and juvenile humeri among the miscellaneous bones are definitely unperforated. At least one of the juveniles mentioned above as "probably male" (#211) is actually a female, according to Turner, but he does find #171 to be male, with no determination on #271 or 287 (he has not made a statement yet on #276 and 486).

Higher frequency on the left side, and among females, is normal (the incidence at Pecos in females is 26 percent right and 30 percent left). Septal aperture of the humerus is common in San Juan Anasazi remains: among Basketmakers, it is about 12 percent of the males and 28 percent of the females; the Whitewater Creek series from near Allantown, Arizona, shows remarkably high percentages–4 or 10 males and 10 of 17 females (Stewart, 1940); then 3 of 6 females but none of the 6 males from Site 34 in Mesa Verde National Park (Reed, 1965); and of 8 males from Alkali Ridge, one right only, one left only, one both, and 5 neither, while none of the 5 females definitely lacks perforation on both sides (Brues, 1946a).

In some areas of the Southwest, the phenomenon seems to be much less common–for example, the Tularosa River Valley (Reed, 1957) and the Galisteo Basin (Reed, Ms. a). In later sections the rather low incidence in the connection from the *campo santo* a Las Humanas will be mentioned, as well as the more or less normal occurrence in the small series from Pueblo Pardo.

The distal end of the right humerus and the head of the right ulna of male #11 show peculiar growths, presumably osteoarthritis, but conceivably representing a healed fracture of the elbow. Males #256 and 281 and female #163 have slight "arthritic" growths on the olecranon process of the ulna.

The head of the right humerus in female #65 is either pathological, undeveloped, or largely destroyed by some affliction that I am unable to diagnose; the scapula, as mentioned above, is also involved. The head of the right humerus of #418 (fig. 70) is rather similar and less far gone, like an early stage of whatever the "affliction" is; the scapula is normal, except for premature in a 27-year-old) glenoid lipping.

Bones of the forearm, which are generally slender but muscular, are normal or typical Southwestern Indian. A few of the males are noted as husky, stout, or less slender than average, and some of the females as exceptionally slender. A few, among both males and females, have "bent" ulnae–curved more sharply than is normal. Lengths of radii and ulnae correspond pretty well–in fact, surprisingly closely–between Las Humanas (the 14 adult radii and 16 adult ulnae from the campo santo fall within the range of the Mound 7 group, although 2 of the ulnae are unusually large), the few specimens from Pardo, the large Pecos collection (80 to 100 males, 43 to 68 females), the little series from Alkali Ridge, and others.

Finally, tiny female #273 exhibits the spectacularly unusual feature of synotosis of the forearms, with the heads of the radii fused with the ulnar facets (see Hayes, 1980, fig. 231).

Femora of both sexes are generally slender (in most of the females) or moderately slender (virtually all of the males, only a few being decidedly large and stout), not particularly bowed, and generally without pilasters, although roughening and prominence (possibly arthritic growth) of the linea aspera in several cases resembles or approaches pilastering. Very slight development of pilasters is noted for between 20 and 25 percent, and small "arthritic" growths sometimes appear in the trochanteric fossa of the femur.

There is a definite third trochanter on the left femur of male #212, and a very slight development of a third trochanter on the right femur in #212, the right only in male #14 and females #202 and 236, and on both of male #209 and females #140, 142, and 254. Occasionally small exostoses or "arthritic" growths at the gluteal ridge simulate a small, third trochanter.

As discussed briefly in my Galisteo Basin report (Reed, Ms. a), trochanters appear to be rather uncommon in the Southwest. There is a fairly high incidence at Pecos, 61 of 558 femora, or 10.9 percent (Hooton, 1930, p. 142, Table V-15). I have one pair from the Galisteo Basin with prominent, well-developed, third trochanters, Burial 60/15 from Pueblo Largo (ibid.); otherwise, I have noted only a few Southwestern examples.

In the very small quantity of skeletal material from sites of Fremont culture in Utah that I have examined, there are a few third trochanters—none from Cisco (Wormington, 1955) or Warren (Reed, 1966c), but a couple of small ones from Lapoint, northeastern Utah (Reed, 1966b), and one from Nephi in central Utah (my report of December 1966 to F.W. Sharrock). These I found to be non-Southwestern and not Ashiwid in physical type, but rather of northern and Plains affiliation, perhaps related to the Deneid type.

No third trochanters were observed in the small collection from southern Utah (consisting of Ashiwid physical type and Anasazi culture), which I have studied (Reed, 1963a). Two of seven pairs of male femora from Alkali Ridge, however, manifested third trochanters (Brues, 1946a).

Tibiae range from slender and flattish to moderately stout. In males, the commonest is a rather slender diaphysis with a concave external (lateral) surface—Hrdlicka's "Type III" (Hooton, 1930, p. 148)—with a few of those being quite thin or flat and approaching the "sabre-shaped" category. In most, the concavity is moderate; in a few more, pronounced; and in several, it is only slight or very slight. A few males have moderately stout tibiae with no concave surface, and a few others have very flat tibiae with no concavity.

Similarly, in females the typical form seems to be a moderately slender tibia, not particularly flattened, Type III, moderately or only slightly concave. Quite a number have no concavity of the external surface, but rather an almond-shaped or diamond-shaped cross section. Tibial heads are often slightly retroverted. When present, squatting facets are indistinct, but generally quite small—in several cases on one side only, and definitely absent in a good many. (From Rao [1966] I gather that I should, or at least, could have gone into far greater detail on squatting facets, but I cannot bring myself to consider this important enough to go back over the collection again for it.) There seems to be remarkably little correlation between retroversion of the tibial head and presence of squatting facets.

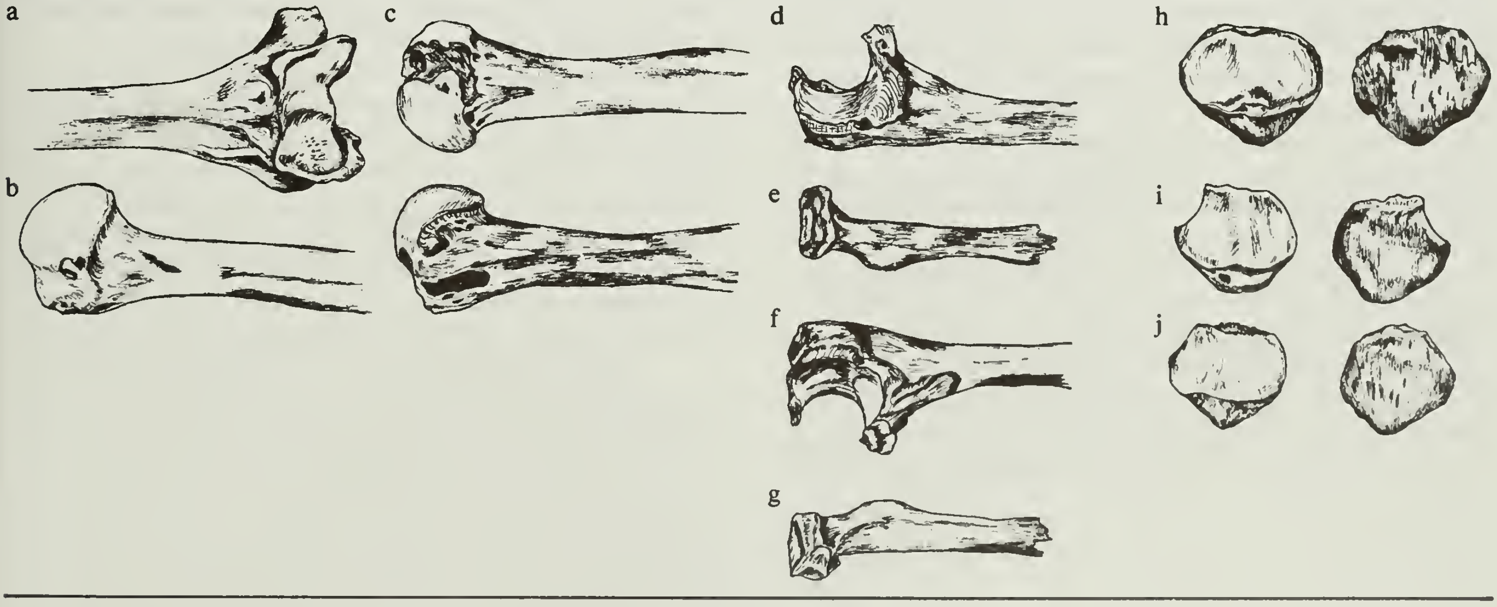
Growths of presumably osteoarthritic nature were observed, as well as osteophytosis on vertebrae, in several individuals: in male #17, for example, along the linea aspera and in the trochanteric fossae of the femora, and on the interosseous surface; in male #26, on the upper portion of the posterior surface of the tibiae; in female #76, on the distal epiphysis of the left femur, both tibial heads, the left cuboid, and (very slightly) on the other tarsal bones; and in female #389, along the linea aspera and on the gluteal ridge, but not in the trochanteric fossa, on the calcanea where there were unusually large internal tubercles, formed into conspicuous hook-shaped protrusions (although not unique, this is a particularly well-developed case), and on several vertebrae—the fifth and sixth cervicals (only very slight on the seventh), the tenth and twelfth thoracic, and the lumbars, especially the fifth, with a little on the edges of the top of the sacrum and, as mentioned above, on the mandibular condyles.

Hematomata of unknown etiology occur in the femora of #339 (female, 20 to 21 years old, whose tibiae are mormal), the tibiae of female adult #57 (as in a campo santo pair of tibiae), and in the left tibia, but not the right, of #441 (mature adult, very probably male).

Comparative data on the dimensions of the leg bones are included in Tables 38 and 39; again, the means are generally surprisingly close between Las Humanas, Pecos, and others listed.

In a number of cases (e.g., #337, 344, 437, 445), the patellae have particularly noticeable concavity of the upper lateral arc (fig. 69), the outer portion of the superior border. Small "arthritic" growths appear occasionally on the patella.

To my surprise "arthritic" exostoses do not appear on metacarpals (metatarsals). Presumably the troubles in the finger joints that occur among many living people are not osteoarthritis, but a mild form of rheumatoid arthritis (see the following section, "Pathological Specimen #391"). The only instance noted of pathological (?—unusual, at least) features in these bones is that in #418, a young adult female with a peculiar head of the right humerus partially "dissolved" (fig. 69), as mentioned above; there are several irregularly distorted bones covered with tiny excrescences or bumps —the second, third, and fourth metatarsals particularly, and the first and fifth and the second and third metacarpals only slightly. Tarsals and those carpals present show no such effect.



70. Miscellaneous bones of the extremities.

Pathological Specimen #391

As a matter of fact virtually every skeleton well enough preserved for thorough study has something peculiar, anomalous, or pathological; there are two exceptions, however—27-year-old female #295 (normal, but lacking the lower left third molar and parietal foramina), and #458, a 19-year-old male, who had nothing unusual showing up on the skeleton.

Although several individuals manifest interesting combinations of rather unusual details or of osteoarthritic (?) developments, only one skeleton absolutely requires complete, separate treatment —#391, a truly spectacular specimen. The limbs are dwarfed, withered, attenuated, and fused. The skull and upper trunk are normal, but from the waist down, and from the glenoid fossae out, the rest of the skeleton is fantastic. The individual appears to have been a youthful adult male, at least in the early, and possibly the late, 20's.

The cranium and mandible have only minor peculiarities, which also occur on others—a large inion tab, numerous Wormian bones, nasal overgrowth, asymmetry of the face, moderately pronounced eversion of the genial angles, and the left condyle of the mandible and its sockets on the cranium expanded.

The scapulae, clavicles, sternum (see fig. 58), and the first 15 vertebrae—the cervicals and eight upper thoracics—are of normal size or larger, and seem quite normal (except for the glenoid fossae of the scapulae); the ribs, however, are unusually curved, bent, and twisted, but in an otherwise normal specimen would not be remarked upon, as post-mortem distortion would be assumed—and may be the case here.

The last few thoracic vertebrae and the lumbars, and probably the sacrum (which is fragmentary and largely missing), apparently were all anylosed into a single column. The innominates are very small and twisted, and the femoral heads are solidly fused into the acetabula. The right femur was permanently vertical, and the left almost, but at an angle forward and medially. The tibia and fibula of one leg are joined at both ends, probably likewise in the other (somewhat broken up). The tarsals and bones of the feet are missing, as are the hyoid, coccyx, one thoracic vertebra, and the coccyx.

The right arm, wrist, and hand are fused at a sharply flexed angle into a single piece. The left arm (now broken apart) evidently was also completely united, but fully extended. The humeral heads were not united with the scapulae, so that limited movement of each arm was evidently possible—there are strongly developed ridges on the humeri—although with no flexibility of wrist or elbow (or fingers, apparently). The glenoid fossae show a little deformation, and premature lipping; otherwise the scapulae appear normal.

All of the long bones are small and thin, reduced to pipestems—or in the case of the fibulae, pipe-cleaner size. The ends of the long bones and finger bones are expanded, but attenuated to mere networks of interrupted surface.

Skeleton #391 has been independently diagnosed by two physicians as rheumatoid arthritis. It surely must be regarded as an extremely severe case. No such specimen, or anything even remotely similar, has come to my attention, either among over a thousand Southwestern archeological skeletons I have examined (this includes, however, infants and highly incomplete burials, but even so) or in the literature on the physical anthropology of the American Indians.

Build and Stature

As a group the Mound 7 series in general is normal, fairly typical Southwestern—rather short people of sturdy muscular type, presumably tending to a predominantly mesomorphic somatotype. The clavioculo-humeral index runs high, over 50 percent in many cases, indicating a broad-shouldered build. The fact that I use the bicondylar length of the humerus may exaggerate this impression, even though the difference between that dimension and the maximum length is usually trivial. But the few available figures on the claviculo-humeral index from other Southwestern material run somewhat lower (tables 38 and 39). Generally, the normal means for human groups other than Australian aborigines fall between 47 and 49 percent (the native Australians according to Ray [1959], run very low, around 43 percent in males). In any case the Las Humanas people and other Pueblo Indians generally are of a sturdy, broad-shouldered build (see discussion in Reed, Ms. a).

As to stature, the Las Humanas population is not precisely normal, even though the male and female means are not very far from those of other Anasazi series from the San Juan and Upper Rio Grande areas (tables 40 and 41). Most other Southwest Plateau (Ashiwid) populations in various districts generally seem to run about the same (ibid.). There is a possibility that the Sinagua people of the Flagstaff area were taller as a group, or at least included more quite tall individuals, than most Pueblo groups (Reed, Ms. g).

The normal Anasazi ranges of reconstructed statures, as calculated by Trotter-Gleser formulae appear to be 155 to 169 or factually, the normal ranges for the sum of femur length and tibia cm. (4 feet 9 inches to 5 feet 1 inch) for the females, with a number of individual exceptions at both ends (Reed, Ms. a). To put it more factually, the normal ranges for the sum or femur length and tibia length are 69 to 81 cm. for males and 66 to 74 cm. for the females (or, femora 38.5 to 45 cm. and 37 to 41 cm. long).

Aside from Las Humanas, at least 20 males over 170 cm. tall are on record from the Southwest—from Alkali Ridge, Wetherill Mesa, and other San Juan Anasazi districts, from Sinagua ruins in the Flagstaff area, from Las Madres (LA:25), Paako, and Pecos (there are quite a few from Pecos, which includes the second tallest individual published from the Southwest). At Point of Pines in eastern Arizona, there is a male approximately the same size as the tallest Pecos specimen—femur length 492 mm., which yields a stature of 178 cm. (5 feet 10 inches)—and the second tallest comes out at 175.8 cm. (Kenneth A. Bennett, personal communication, 1966). But these are exceptional individuals.

Consequently, the number of tall males at Las Humanas is remarkable—13 of 40, or almost one-third, are over 169 cm. There are only two Mound 7 specimens at less than about 161 cm., #161 and either #329 or 175; the first two of these are calculated at about 158 cm. from the femur alone, which regularly yields, since Southwestern Indian material results a couple of centimeters less than femur and tibia combined. From Pueblo Pardo, however, there is one at about 159 cm. and one at 160 cm.; there are none over 170 cm. and the mean is only 164.3 cm. (64 3/5 inches).

At the osteology laboratory of the University of Arizona, in February 1967, and through the generous courtesy of Kenneth A. Bennett, I examined the copies that he had obtained of the original file of Dr. Hooton's measurements on the Pecos material.

In the Pecos collection, there are 19 males with femora over 450 mm. long and tibiae over 380 mm., a combination yielding a stature of 171.6 cm. (66½ inches) by the Trotter and Gleser (1958) Mongoloid formula. Of these, only three are over 470 mm. /390 mm.—two of them close to this (which gives 175.3 cm., or 69 inches), the other, an extremely tall individual (#60.232) with "heavy muscular skeleton"–495 plus 415 mm. gives 181.4 cm., or nearly 6 feet tall. The 16 males with femora between 450 and 465 mm. long have tibiae 361 to 401 mm. long. One of the 470 mm./392 mm. males has humeri 346 and 347 mm. long, the other only 326 mm.; the exceptionally large #60.232 has the largest humeri, 356 and 358 mm. long.

This last individual is not from the late period of greatest Plains influence, but from the earliest phase at Pecos, the time of the original Anasazi colony, with Black-on-white pottery and Glaze I. And the other tall individuals do not cluster in any one period: four are in Glaze I-B/w, seven in Glaze II-III, five in Glaze IV, and two (plus three almost qualifying) in Glaze V-VI.

There are only five Pecos males with femur lengths under 390 mm. and/or tibiae less than 320 mm. long, a combination yielding a reconstructed stature of 157 cm., or 61 4/5 inches, within what I have called the normal Anasazi range. The femur/tibia lengths, in mm., are: 362/(288?), 383/319, (394)/318, 393/314, and –/312. Aside from the first (exceptional at about 150 cm., or 4 feet 11 inches), these run 155 to 157 cm. (61 to 61½ inches) at the bottom of the "normal" range.

The small series from LA:25 in the Galisteo Basin compares remarkbly close to the Las Humanas collection in range and mean. The material from two other Galisteo Basin sites, Pueblo Largo and LA:3333, fits into the same pattern. the large series from Paako includes a number of short individuals, and the mean is exceptionally low. The series from Te'ewi, one of the few available in the upper Rio Grande area, is very similar to Pecos.

Various individual male specimens, or lots of two or three, which I have studied from Anasazi sites in the San Juan and Upper Rio Grande usually run around 164 to 166 cm. (about 5 feet 5 inches) with, of course, occasional exceptions. Thus, I strongly suspect a significant infusion from the Plains at Pecos and in the Galisteo Basin, and at least at Las Humanas (but apparently not at Pueblo Pardo close by) in the Gran Quivira district. The very large Pecos collection, as discussed above, includes tall men as well as rather small ones, and the mean is at the normal Anasazi (San Juan) average.

In any case, it is clear that the Las Humanas male population was decidedly on the tall side compared with most Anasazi groups, and this seems to be true for much of the eastern margin of the Pueblo area.

The situation with females is somewhat different. The normal range of 145 to 155 cm. that I give for Anasazi material has very few, if any, exceptions at the lower end within the San Juan area, but several at the upper (and perhaps I should set the figure higher, say at 157.5 cm., or 62 inches).

In addition to a few Sinagua females about 147 to 158 cm. tall, one of two females from a Kayenta (Anasazi) site in Flagstaff districts, NA:862, figures out at 157 cm. by the Trotter-Gleser (1952) White formula (but only 153.3 cm. by Pearson, [1899]). In any case, however, it is not the impossibly high figure of? published–presumably misprinted–in Smith (1952a).

There is a measurement of 157.5 cm. (153.6 cm. according to Pearson) from Allantown in the Whitewater Creek locality of Arizona, southwest of Gallup, New Mexico (Stewart, 1940). From Wetherill Mesa, K.A. Bennett (1975) described four females between 157 and 160 cm. tall. And there is a surprisingly tall group of women from Inscription House, Navajo National Monument in northeastern Arizona (see table 41).

In the Upper Rio Grande, I have a few specimens listed as females that are 162 to 164 cm. tall, but I am uncertain as to the correctness of my sexing (as in the case of one from site Bc 362 in Chaco Canyon). But there is one I am confident about. Museum of New Mexico specimen 44391/18, from a site close to Nambé and about 15 miles north of Santa Fe, is a female with a reconstructed stature of 160.5 cm. (Pearson [1899] listed it as 156 cm.)

Otherwise, the tall women in the Rio Grande area come from the same ruins on the eastern fringe. Aside from Pecos and Las Humanas (see table 41), there is Burial No. 11 from Las Madres (LA:25), about 158 cm.; Burial 60/3 from Pueblo Large, 156.7 cm.; and Burial No. 8 at Paako, 157.5 cm. (5 feet 2 inches). As in the San Juan area, an upper limit of 157 or 158 cm. for the "normal" range would leave only very few exceptions, except at Las Humanas and Pecos.

There are 10 Pecos females over 415 mm./350 mm., which gives a Pearson stature of 155.3 cm., or a Trotter-Gleser (White) stature of 159.5 cm. (62 2/3 inches). Only three of these are at or over 430 mm./360 mm. (or 158 to 163 cm.)–over this, only #60.059, whose 445 plus 369 mm. would indicate a stature of 161 cm. (63 2/5 inches) or 166.5 cm. (65½ inches).

In the Mound 7 collection, there are 15 females, and possibly 21 (out of 50 definite and a total of 67, respectively), over 156 cm. by Trotter-Gleser calculations, and 5 of them are over 156 cm. by Pearson and over 160.5 cm. by Trotter-Gleser. Again, this is a notable percentage of tall individuals. None of the femora in the campo santo collection listed as female yield high statures, but this means nothing–they were identified as to sex on the basis of length and of diameter of head under 42 mm. Transferring #262 to the female category adds one more than is over 156 cm. by Pearson and over 160.5 cm. by the Trotter and Gleser formula for White females.

Of two measurable Pueblo Pardo females, one is very normal, about 153 cm., while the other is on the tall side, although not really exceptional, at almost 157 cm. Again, it appears reasonable to speak of high statures on the eastern rim, compared with the Rio Grande Valley and the San Juan region, and to consider the possibility of a strong Plains element in the late Pueblo IV population.

The female means for Pecos, Las Humanas, and Pueblo Largo (virtually identical), however, are not far different from those of Paako and San Juan Anasazi sites.

The puzzling or startling, or at least mildly interesting, item is that the smallest females known also come from this eastern border area. The shortest adult on record from the Southwest is Burial No. 4 from LA:3333 in the Galisteo Basin, a small pithouse site of the late 13th century excavated in 1962 in the Highway Salvage program of the Museum of New Mexico (description of skeletal material, Reed, Ms. d): With a femur length of 340 mm. and a tibia length of 275 mm., the specimen has an estimated stature of about 138.4 cm. (4 feet 6½ inches).

The next smallest individual is Las Humanas #273, at 4 feet 7 inches (139.6 or 136.7 cm.). Only two others from Mound 7 are perhaps very short (our data are not definite)–#162 at (143?) cm. (from an uncertain femur length alone), and #282 at about 142 cm. (but from the tibia alone, 148.5 cm. by Trotter-Gleser and 145.3 cm. by Pearson; I may have seriously underestimated the length of the damaged femur). About the only other extremely short individual from the Southwest, as far as I know, is represented by a femur 347 mm. long (indicating a stature of about 140 cm., or 4 feet 7 inches) in the U.S. National Museum from Stone Axe Ruin at Wallace Tank in the Petrified Forest area of Arizona (T.D. Stewart, personal communication, 1951).

Finally, there are nine Pecos females under 370 mm./310 mm. (or 145.7 cm. by Pearson, 147.7 cm. by Trotter and Gleser; i.e., between 4 feet 9 inches and 4 feet 10 inches). Three of these femora less than 360 mm. long; two of them lack tibiae, while the other has the only tibiae under 300 mm.–at 358 plus 297 mm., #59877 comes out at 143.3 cm. by Pearson, 144.3 cm. by Trotter and Gleser, or 4 feet 8½ inches to 4 feet 8 3/4 inches. The other two with 357-mm. femora presumably were about the same size. Next would be one at 365 mm./305 mm., for a stature of 144.5 cm. (Pearson) or 146.2 cm. (4 feet 9 3/5 inches).

The significance, if any, of the smaller statured females eludes me. And it may be that the apparent frequency of tiny women in this area is actually a function of the relative abundance of material–the very large Pecos collection, and the Mound 7 remains, second in size among those studied and published so far from the Southwest. But the high incidence of tall individuals, particularly males, probably is not illusory and may justifiably be taken, along with other traits, both physical and cultural, as very likely representing influence from the Plains.

The distribution of tall and small statures, male and female, between Early, Middle, and Late Phases of occupation at Las Humanas does not appear significant. A most intriguing hint of clustering of tall males in the Middle Phase and of females in the Middle and Late Phases is dispelled by the fact that most of the specimens come from these horizons, and the male statures of 164 to 169 cm. and females 144 to 155 cm. show a similar distribution.

Nevertheless, there is a possibility of such a trend: the range of estimated stature for five males definitely of the Early Phase is 157.8 to 169.2 cm., and the mean is 163.25 cm., with only one, #265, over 167 cm. For 8 males definitely of the Middle Phase, the mean is 168 cm., and for 12 males of the Late Phase, 166.33 cm.; the range for Middle and Late Phases combined, including 4 more that are "late Middle" or "Middle or Late," is 160.7 to 172 cm. Similarly with females: for the Early Phase, the mean of 6 specimens is 150.8 cm. (ranging from 147.7 to 154.4 cm.) *without* including tiny #273 at 139.7 cm.; for the Middle Phase, the mean of 11 is 155.8 cm. (ranging from 149.1 to 162.6 cm., including #262 as a female); and for the Late Phase, the mean of 19 is 154.9 cm. (ranging from 145.5 to 161.9 cm., with 13 of the 19 between 153 and 157.5 cm.).

Summary

In addition to 149 cremations, and a great quantity of scattered bones and fragments (of which some are usable and a few have points of interest), 361 individual unburned inhumations, many of them incomplete or very fragmentary, were recovered in three seasons of excavation in Mound 7 at Las Humanas, Gran Quivira National Monument. Of these, 212 are infants, children, and adolescents; 149 were over 18 years old at death, with concentration between ageo 27 and 42, and very few at 50 or over. There are approximately 115 usable adult skeletons and 65 measurable skulls.

The crania are predominantly undeformed, and very few are at all strongly deformed. Very slight to moderate flattening, at an angle near vertical or intermediate between vertical and oblique ("lambdoid") is typical of the deformed material, and is characteristic in the Early Phase (Glaze A times, 14th and 15th centuries), although appearing later also.

The natural features of the skull manifest considerable variation in many traits, although it is seldom clear outside the normal range of the Southwest Plateau type, as well as a number of unusual anomalies. Certain of the latter will be discussed in the final section of this report in some detail. Of special interest are the numerous individuals with a non-Southwestern appearance.

There are also numerous variations and pathological features in the post-cranial skeleton. The humero-clavicular index runs generally high, indicating a sturdy, broad-shouldered build. Robusticity of the limbs is moderately strong in general. Reconstructed stature, as calculated from the bones of the leg, is generally above the normal Southwest Plateau average, with a high percentage of males over 169 cm. (66½ inches) and females over 156 cm. (61½ inches). Only a few males are at less than 161 cm. (63 2/5 inches); but one exceptionally short female was calculated at just under 140 cm., or about 55 inches. No definite correlation of stature with time period (construction phase) appears.

Human Bones from the Campo Santo of San Isidro

The skeletal remains collected in the campo santo at Las Humanas in the 1956 work include 23 crania (all but eight of them lacking mandibles), plus three unassigned mandibles and a quantity can be assigned to recognizable individuals, notably some of the few children. Accordingly, each bone has been studied as a separate unit, and age for crania and most of the long bones is thus given only in very general terms.

The three skeletons collected in October, 1967, are adults, in fairly good condtition. They were designated as Burial A (Q5008/37, mature male), B (Q5009/37, mature female), and C (Q5010/37, young adult female). They are described separately in a later section.

Features of the Crania

Twenty skulls are fully adult (tables 42 and 43); there are also two children (#1 and 17) about 7 years old, and another (#2) close to 9 years. Twelve of the adult crania are listed as probably male, and six as female; two (#21 and 23), highly incomplete and impossible to sex–each consisting of the posterior portion of calva. Partial calvarium #22 lacks the frontal as well as the face, but is classified as probably female.

As with skulls from Pueblo Pardo and Mound 7, the question of artificial cranial deformation is a difficult one here, at least for most of the males. Four of the six females show definite occipital deformation, vertical or close enough to actually vertical; one (#14) is equally clearly undeformed; and only one female, #22, manifests the vague occipital flattening, not well defined and not flat, that is baffling me so in this area.

In summary, the 12 males, the 2 calvae of uncertain sex, and the 3 children fall into the following cranial deformation categories:

1. slight lambdoid flattening, "not flat"–four (#16, 17, 18, 19)
2. slight and limited occipital flattening, not quite vertical and not quite flat, but not entirely post-mortem or purely natural–four (#3, 13, 15, 23)
3. moderately pronounced, at a fully "lambdoid" angle–one (#21)
4. very pronounced and true vertical occipital–one (#4)
5. irregular distortion, probably not, or not entirely, post-mortem–two (#5, 11)
6. none (except any post-mortem distortion)–five (#1, 8, 9, 12, 20)

The fact that the sixth category, definitely undeformed, is the largest sub-group inclines me still more to discount some of the seeming deformation of others, yet much of this can scarcely be post-mortem distortion. Comparable situations in the collections from Pueblo Pardo and Mound 7 have been described and discussed.

The outline of the skull viewed from above, in the *norma verticalis*, falls generally between ovoid and pentagonoid, with a few of the specimens that are considered as definitely undeformed listed as ovoid. The occipital protuberance, conspicuous in some of the Pardo material, has not appeared so far at Las Humanas.

The occipital torus varies quite a bit in this series. Four examples of a quite strong torus are somewhat unusual, constituting a seeming distinction from the Pardo collection and most of the Mound 7 material. Male #16 has a remarkably well-developed sharp ridge; male #19 a definite ridge with a well-defined inion projection, which is unusual in Southwestern material; middle-aged male #4 has a strong crescentic ridge-shaped torus, surviving conspicuously although somewhat flattened by deformation; and finally, #21 has a fairly strong mound, although again somewhat flattened by deformation. On the females and on the balance of the males, the occipital tori are slight or sub-medium, or moderately developed, but not sharply defined.

Sutural complexity is generally quite low, only moderate in even the lambdoid suture in a few, and low in others. There are three exceptions–highly serrate lambdoid sutures in males #18 and 20, and comparatively high complexity with a notably denticulate lambdoid suture in undeformed female #14. On cranium #5 the left half of the coronal suture has almost completely disappeared. Wormian bones are rare, with occurrence of a few in the lambdoid sutures of two crania (#6 and 13), a single one in the left half of the lambdoid suture of #19, and three specimens with several: 9-year-old #1 and male #20 have several rather large Wormian bones around lambda (in #1 but not in #20, forming or including a definable Inca bone, and also in #1 a few between the occipital and temporal bones), and female #14 has numerous little ones in the intricate lambdoid suture, including one at lambda. The occipital of #15, with sutures obliterating, has a row of pits giving the effect of an obliterated horizontal suture of a small symmetrical Inca bone. And in that of #12, the horizontal suture of a formerly distinct small Inca bone is still clear, while the upper portions of the lambdoid suture are nearly obliterated.

Mastoid processes are small to medium-sized; the supramastoid ridges are notably strongly marked in several individuals. No dehiscences of the tympanic plate were found in this series. Individual special features of the skull vault and base noted include two retromastoid foramina, one of them quite large, in the right temporal bone (a single medium-sized one on the left side) in male #9; a peculiar bulging effect between temporals and occipital on male #19; and, one of the few pathological items, two button osteomata on the frontal of #12.

Details of the Face

Glabbellar prominence, although slight, is definite on all observable specimens except two of the females (#6 and 14 have none at all, and no brow ridges). On the males brow ridges are small to moderate and of Type II, extending over the median (inner) halves of the orbits; brow ridges are absent on three females, and very slight–in fact, only a trace shows–on females #7 and 10, and not observable on #22.

The supraorbital foramina or notches appear as rather wide and shallow notches in six cases, and small notches are almost closed in to form a pair of foramina in male #12. There are small foramina in five cases, and one of each in two (#14 and 20). Neither, nothing whatever, shows in #8. In the other five specimens (including the three children), the occurrence is undeterminable.

Orbit shape is generally rhomboid, or "oblong with rounded corners," with a few more nearly oval or more definitely oblong; the inclination of the orbits runs from slightly to moderately sloping (eight slightly or very slightly, three moderately), with three markedly inclined (#9, 15, and 19), and three listed as horizontal (#3, 5, and 14).

The nasal profile is concavo-convex in the observable males, with fairly well-arched nasalia. In a few specimens–#13, 15, and 19–the nasalia are particularly long, with a high and narrow nasal root. Marked nasal overgrowth–the best example I have seen–also characterizes #13, with very slight nasal overgrowth in #15 and also in female #3 (although the nasal profile is low and the nasalia actually short). Short nasalia with a concave profile occur in the other observable females.

Malars are large or of moderate size and quite prominent in some of the males, but small and not particularly projecting in other and in the females. Infraorbital foramina run quite large in most cases, on the small side in only two (#13 and 20) and medium-sized in three (#6, 8, and 11). The suborbital area (canine fossa) varies in degree of concavity: it is deep or moderately so in nine cases, slight or very slight in six, and absent (a flat maxilla) in #9; in #19 the right is concave, although only slightly, and the left is flat. In two of those listed as slightly concave, there is almost none, a nearly flat area.

Other, special, individual features among facial details include conspicuously strong zygomaxillary tuberosities on the malars (of moderate size and projection) of #16, very prominent nasal spine and notably sloping orbits of #19, and small round piriform aperture and "square upper lip" of #13. Now, the last phrase is no doubt unscientific, or certainly non-technical at least, but I can find no other wording to describe this condition, which combines marked alveolar prognathism with a squared or angulated alveolar portion of the maxilla. I have observed this on Southern Paiute skulls from Utah, but only very rarely in Southwest Plateau material.

Mandibles and Teeth

The jaws are generally normal–large or moderate in size for males, and small for the females. The jaw of male #15 is notably large, and that of elderly male #12 much reduced by tooth loss and resorption. The chin is only fairly strong and not especially prominent in almost all cases; it is bilateral in most males and female #13, and of median type in female #6 and male #18.

Gonial eversion is really present in only one case (large male #15, to a pronounced degree), and perhaps a second (slight, on male #5); it is very slight on males #12, 16, and 18 (left side only), and completely lacking in female #6, male #13, and unassigned mandible B.

No mandibular or palatine tori occur in this material.

There are nine more or less complete dentitions available for study, as well as eight more upper dentitions and the three unassigned mandibles. Tooth wear is only moderately severe in most cases, and so these crania must largely represent quite young adults. Only for #5, 9, and 15 is tooth wear listed as very severe (it undoubtedly would be for elderly male #12 if he had any teeth left). Very little incidence of caries was observed–in fact, none at all on most specimens. There is a large cavity in the lower left first molar of #5, and one in the upper left third molar of #13. A "shovel shape" of the incisors was unmistakable on all observable specimens.

In two cases, the third molars were much reduced in size compared with the other molar teeth, and #16 lacked not only the third molars, but jaw space to accommodate any.

Pre-mortem tooth loss was less than seems usual in Southwestern crania. This is ascribable to the high percentage of young adults, as suggested by the comparatively low incidence of tooth wear, or at least it tends to corroborate that indication. No teeth had been lost in four of the paired sets, in three additional upper jaws, and in one unassigned mandible (B). In others, many of the molars had been lost, with resorption. Skull #12 had long since lost all upper teeth, as well as lower molars and premolars.

Crowding of teeth seems not to occur except perhaps in #8 (maxilla only), where, however, post-mortem loss of the actual teeth and slight damage on the right side make for uncertainty. The only other dental feature or anomaly noted is in the maxilla of #6 –a bud of a very small extra tooth in a separate little socket beside the empty socket of the upper left third molar (lost post-mortem).

Post-Cranial Bones

Spines and Pelves

Among 15 right innominates and 13 left innominates, there are 4 adult male pairs (and an extra right), 6 pairs of rather small female, an unmatched right of a large but youthful (Stage III, age 22-24) female, 3 bones of small children (a pair and an extra left), and 2 quite young adult female left innominates–one with the iliac crest just freshly joined, the other not yet, both in Stage II (age 20-22) of development of the public symphysis. The age-stages of the pubic symphyses of the other innominates confirm the various other indications that most of the individuals represented by this collection are mature but fairly youthful adults.

There are 14 sacra, more or less complete; 7 (and a probable, incomplete eighth) of them are normal adult five-segment, including 2 youthful ones with distinct gaps between S1 and S2 and the S2/S3 gaps not completely closed. Five of these, including the two young ones, are small and moderately curved, one is large and sharply curved, and one is quite narrow and straight. There are two segments of a juvenile sacrum, and two from a much smaller child.

Four examples of the variation of the sacrum that is so frequent in Southwestern material are one four-segment specimen, small and moderately curved; a large and strongly curved six-segment sacrum, the top segment formed by incorporation of a fifth (or sixth?) lumbar vertebra, with considerable arthritic lipping; and a probable second six-segment specimen, in fragments, evidently closely similar to the one just described. A fourteenth individual is represented by a fragment closely resembling the last but not fitting with–instead, overlapping–the other pieces.

There is a fairly large number of pre-sacral vertebrae, many of them juvenile; a few, presumably elderly, with extreme osteophytosis, but none are ankylosed, and no other special features have been observed.

Scapulae

There are 26 shoulder blades (15 right and 11 left). Except for one pair, all are mature, with very little or no lipping of the glenoid fossae, except in one pair and an unmatched left (in other words, almost all are young or fairly youthful adults). No pathological features or anomalies were observed.

Clavicles

There are 2 right and 2 left juvenile specimens, and 8 right and 10 left adult clavicles, not all pairing off readily. The two youthful right clavicles, #149 and 184, have medial (sternal) epiphyses that are freshly joined (yet the lateral ends appear immature), and on the two left clavicles, the sternal epiphyses are not yet joined at all–therefore, under 27 years old at most. There is considerable variation in size. The smallest adult specimens are #149 and 184 (the pair mentioned above), each 127 mm. long; the big one, #197, is 155 mm. long.

Humeri

Only a few of the 16 right and 15 left humeri can be paired with no hesitation or question. There are two juvenile rights, diaphyses 180 and 200 mm. long, which means (by way of 73 percent of calculated femur lengths of about 245 and 275 mm.) that the ages are close to 7 and 9 years, respectively. There are four juvenile left humeri, two of the 7-year-old size and one at 200 mm. (these presumably correspond to skulls #1, 17, and 2), and a fragment of a much larger one whose age is not determinable.

The 14 adult right humeri include four large, four moderately large, and three small, with the other four moderate. Those with transverse diameter of the humeral head over 42 mm. (see Table 44) are undoubtedly male, while those under 40 are surely female. The three specimens at 42 mm. might be either; the length of #86 suggests male in spite of the small head size. The head of #67 (table 45) is very recently united to the shaft, the line of juncture being clearly visible around most of the circumference, indicating an age at death of close to 20 years.

Muscular development and humeral torsion are slight or only moderate in most of these bones (exceptions: right #74, 75, 76, 82, and left #60 and 67; but even these are generally slender). None of the right humeri show perforation of the olecranon fossa, but two lefts (#67, and 87) do have this septal aperture. This and the Mound 7 incidence are lower than that at Pardo or than is usual elsewhere in the Southwest.

Bones of the Forearm

Specimens of the radius comprise eight right and nine left; the former group includes one from a small juvenile, and one with proximal epiphysis on, but not the distal (i.e., around 18 years old); there is a left of the same child but not of the sub-adult. None of the adult right and left radii can be paired at all surely. Three of the right adult radii are large and strong, and three are quite slender. Four of the left radii are long but alender, and three quite small (and all of the same length, 222 mm.–see table 45–corresponding exactly to *one* right).

There are 20 ulnae: those of one small child, those of the 18-year-old sub-adult, and 8 adult right and 8 left, not pairing up.

A right ulna, #120, is unusually stout for a Southwestern Indian armbone, and is 264 mm. long; it is not matched by a left. Left ulna #132, however, is even longer, about or at least 270 mm., but not stout or deeply ridged. Finally, the shaft of left ulna #124, not paralleled by a right, is greatly swollen (a hematoma or inflammation), comparable to tibiae #162 and 173 (see following paragraphs).

Bones of the Leg

Pairing of the femora was partly possible with some assurance, at least to a greater extent than for the humeri. In the first place, both femora of a 3-year-old child (length of diaphysis about 130 mm.) are present. Second, of two juvenile lefts, one corresponds to one of the four juvenile rights, but the other left femur is distinctly smaller, and at a 230-mm. length represents a 7-year-old, presumably corresponding to either skull #7 or 17 and humeri mentioned above. The four juvenile right femora range between 255 and 275 mm. long: in other words, about 9 years old.

The dimensions of 8 adult right femora (5 surely male, 2 very probably female, one uncertain) and 11 left are listed in Table 46. The only definitely certain pairs are #34–47, #30–46, and #33-48; very probable are #32–53 and #38–54.

Pilastering is negligible, except for slight development on two femora (#32 and 53). A very small third trochanter noted for specimen #42.

Reconstructed statures (i.e., femur lengths) are a little on the tall side for males, although well within Pecos and San Juan Anasazi ranges. The 5-foot-tall females are right at the usual Anasazi average.

There are 30 tibiae in the collection: 6 juvenile, all rights; 9 adult right tibiae; and 15 lefts, all adult. Two of the adult right tibiae (#156 and 152) are large and masculine—388 and 384 mm. long; four (#151, 157, 164, and 163) are small—320 to 330 mm. long—are surely female; and three (#158, 162, and 165) are of intermediate size, 336 mm. long, and uncertain sex (cf. table 46).

With the few exceptions noted below, the tibiae are from slender to only moderately stout, and of Type III cross section with concave external surface (cf. Hooton, 1930, p. 148), flattened but not so much as to be “saber-shaped”; there is some retroversion of tibial heads but little or no development of squatting facets. The exceptions to this description are: (1) flattened, approaching “saber” shape, but still essentially Type III—right #157 and lefts #174 and 178; (2) no definite concavity of the external surface—lefts #172 (resembles Type V, but the convex posterior surface is clearly demarcated from the internal and external surfaces) and 174 (transitional between Type III and Type IV); (3) pronounced retroversion of the tibial head—#177; and (4) definite, small, but well-defined squatting facets—rights #151 and 162, lefts #168, 178, and 180.

Few pairs can be established, except for #162 and 173, with markedly swollen shafts—hematomata, no doubt, corresponding to left ulna #124.

There are 23 adult fibulae, 10 right and 13 left. In the former group, seven are small, 325 to 335 mm. long, and three are large and presumably male. Number 16 is especially stout, 375 mm. long: the other two are close to the same length, but not as hefty. Among the 13 left fibulae, 9 are of the 325-335-mm. category, and one still smaller (but fully adult), #109, only 309 mm. long. Number 104 corresponds to #98, and #111 (about 350 to 360 mm. long) corresponds to #95, the distal ends being gone on both. Bony “hooks,” exostoses of presumably arthritic etiology, occur on the proximal end of #16 and the distal end of #95.

Skeletons Collected in October 1967 and July 1968

Burial A

Campo Santo Burial A is a mature adult male in generally fair to good condition. Badly damaged and incomplete bones are the sternum, hyoid, several ribs, nine thoracic vertebrae, innominates (especially pubes), left radius, right ulna, distal end of right femur, patellae (especially the right), right tibia, and several bones of hands and feet). Catalog number: Q/5008/37.

Cranium

The cranium is undeformed, fairly large, and high-vaulted; it is a long ovoid with a protubuant occiput. The *os inca* is a true interparietal bone, the occipital divided from asterior to asterion.

The occipital torus, not clearly defined, is a broad mound. Sutural complexity is moderate, with no (?) Wormian bones (although sutural obliteration is well begun). The pterion is apparently in a narrow H-form. Parietal bosses are fairly well developed, and there is a slight saggital elevation between obelion and bregma. There is a single parietal foramen, and two button osteomata occur on the right parietal. The mastoid processes and supramastoid crests are medium. There seems to be a dehiscence in the tympanic plate on the left side, which may be actually post-mortem damage). No pharyngeal fossa occur on the basilar process of the occipital.

The frontal height and fullness are medium, with no development of frontal bosses. There is a very slight glabellar prominence, and very small median brow ridges. The supraorbital foramen on the left is quite small as opposed to a large notch on the right. The orbits are roundish with very little slope. The malars are rather large—quite prominent both anteriorly and laterally—with a fairly well-developed zygomaxillary tubercle. The nasalia are short but prominent, concavo-convex, with no overgrowth. The nasal spine is very small and undeveloped. The infraorbital foramina are large, and the suborbital concavity (canine fossa) very slight, and greater on the left. The alveolar prognathism is moderate (normal).

Mandible

The mandible is strong and square, with a prominent square chin of medio-bilateral type, with very slight gonial eversion.

Dentition

Tooth wear is quite severe (although not extreme), except on the lower third molars. Evidently the upper third molars never erupted. Probably no pre-mortem losses occurred—at any rate, not long enough before death for any resorption. The missing left lower first molar and right upper first molar, however, may well have been lost. Crowding of teeth is only slight, but there is an unusually high degree of “winging” of the upper central incisors—that is, they are somewhat rotated, with the medial edges turned inward.

Thorax

From the one large fragment present (much of the anterior surface of the gladiolus), the sternum was evidently quite large, clearly with detached manubrium, and apparently with a sternal foramen. The ribs, so far as observable, show no features of interest.

Shoulder Girdle

The clavicles are normal, rather large and mature. The scapulae have extensive lipping of the rim of the glenoid fossa, and the suprascapular notches are normal and semi-circular (that on the right is quite small).

Pelvis

The pelvis is mature, and fairly definitely male. There is a strange outgrowth, a ridge or large point of bone, on the upper external surface of the right ilium, at or about on the superior curved line (between the areas of attachment of the gluteus maximus and the gluteus medius). The projection is about 15 mm. "high" (the lateral dimension at its upper end) and approximately 40 mm. long.

Spine

The cervicals show (1) very slight osteophytosis on the sixth only, and (2) peculiar development–wide splaying, with slight porosis–of the right inferior articular surface of the axis, the right superior articular surface of the third cervical, the left inferior articular surface of the fourth, and the left superior articular surface of the fifth. Only the first, eleventh, and twelfth thoracic vertebrae are undamaged; the eleventh shows a little osteophytosis. The bodies of seven other vertebrae, and fragments of another, are present, with osteophytes on a few. The remains included a normal five-segment sacrum, but not coccyx.

Arms

The humeri are of moderate size, not particularly muscular or twisted, and not perforated. The bones of the forearm are strong, with very slight "arthritic" growths on the posterior surfaces of the ulnar heads.

Legs

The femora are normal and of moderate size, with roughness along the linea aspera, but no actual pilastering, and a slight development of a kind of a third trochanter on the right only. The tibiae are flattened, approaching "saber-shaped," but Type III–nevertheless–they have a concave external (lateral) surface, retroverted tibial heads, and well-developed squatting facets. On the left tibia a rough bony growth occurs on the popliteal oblique line and on the medial edge of the distal end. The fibulae are normal. The patellae, especially the right, have a concave outer section of superior border–a virtual notch or incisura.

Hands and Feet

Projections or "hooks"–outgrowths or osteophytes–appear on the posterior surfaces of the calcanea, as well as on, and prolonging, the internal tubercles of the calcanea. The tali and cuboids are normal. The scaphoids are missing. There are a few extra tarsals and metatarsals from another smaller individual, and although several have been eliminated, I am less certain about the cuneiforms and fourth and fifth metatarsals. The pair of rather large first metatarsals that undoubtedly do belong to Burial A have a little extra growth of the margin of the head, particularly on the right. The pair of second metatarsals have slightly bumpy shafts like Mound 7 specimen #418.

Burial B

Campo Santo Burial B is a mature adult female in generally excellent condition, except for a few items, most of them important. Missing entirely are the hyoid, many carpals and phalanges (but again, there are a few extra tarsals), a few ribs probably unrepresented among the fragments, and the left patella. A number of items are seriously damaged: the maxillae, palate, and nasalia; the mandible; the innominates (public symphysis missing again); several ribs (but 17 unbroken); two central thoracic vertebrae; and the right ulna. Catalog number: Q/5009/37.

Cranium

The cranium shows occipital deformation, at an angle very close to vertical; it is moderate in degree and only very slightly asymmetrical. The occipital torus is a broad low mound. Sutural complexity is moderate, with several Wormian bones in the lambdoid suture. The pterion is a moderately wide "H." No parietal foramina occur. Retromastoid foramen is very large on the right temporal, but quite small and in the suture on the left side. The mastoid processes are quite small, with the supramastoid crests undeveloped. Small dehiscences (?) appear in the tympanic plates. There is no pharyngeal fossa. There is a precondylar "tubercle"–actually just a flat "smearing" of the anterior margin of the foramen magnum. The frontal height and fullness are rather low. Glabellar prominence is slight, but with strong brow ridges (for a female). The supraorbital foramina are very small. The orbits are rhomboid and moderately inclined. Malars are prominent but small, with only very slight development of zygomaxillary tubercles. The details of the nasal skeleton are uncertain, but the nasal spine is small. The infraorbital foramina are large, with concave suborbital areas (well-marked canine fossae). Alveolar prognathism is moderately pronounced.

Mandible

The mandible is small and slender, with short and sloping ascending rami, and a very prominent chin of medio-bilateral type with very slight gonial eversion.

Dentition

Tooth wear is extreme. Pre-mortem losses include all lower molars and the lower left second premolar, upper third molars and probably first molars, and at least one upper premolar (second right). The dentition is not crowded.

Thorax

The sternum is normal but with a small gladiolus, a manubrium not united, and no xiphoid. Although the ribs are normal, some ossification of cartilage occurs on the sternal end of the right first rib, and a tiny bit on the left twelfth.

Shoulder Girdle

The clavicles are long and slender and fully mature. The beginning of lipping of the glenoid fossa shows on the scapulae. The suprascapular notch is almost imperceptible on the left, but undeterminable on the right because of damage.

Pelvis

The pelvis is mature and distinctly female. The innominates are normal (six-segment sacrum from incorporation of the coccyx).

Spine

The atlas has a well-defined "precondylar" tubercle on the upper surface of the anterior arch, and also a small osteophyte projecting down from the under side. The right inferior articular surface of the third cervical, the right superior articular surface of the fourth, both inferior articular surfaces of the seventh cervical, and both superior articular surfaces of the first thoracic are overgrown and with pores; the right inferior articular surface of the axis and the right superior articular surface of the third cervical show just a little bit of this condition. The sixth cervical appears to be perfectly normal. On the right side of the body of the first thoracic vertebra, the articular facet for the head of the right first rib shows a condition similar to that described above for articular surfaces of cervicals; this reappears further down on both sides of the twelfth, and to a slight degree on the tenth and eleventh thoracic vertebrae. On the tenth thoracic, as on the eleventh and twelfth, facets are lacking on the transverse process (not an unusual phenomenon). All five lumbars have osteophytosis on margins of the vertebral body, with particularly large growths on the fourth and fifth. The sacrum, with which the coccyx is united, has ostephytes (a large one at the left) on the lateral margins of the superior articular surface ("base").

Arms

The humeri are slender and muscular, with septal apertures—a small perforation in the right, and a much longer one (5.5 x 3mm.) in the left. The bones of the forearm are normal–slender, muscular, and somewhat curved.

Legs

The slender femora show a slight development of pilasters, the right with a third trochanter—or at least a rough projecting ridge, like an osteophyte, at that location. The tibiae are rather stout with a very slight concavity of the external (lateral) surface; in cross section they are almost almond-shaped. The fibulae are normal. The right patella shows a pronounced concavity of the lateral section of the superior border, and a small osteophyte just below it.

Hands and Feet

Again, the internal tubercles of the calcanea are prolonged forward by additional bony growths, and the scaphoid of the right tarsus (but not the left) has a small osteophyte on the tubercle. Otherwise, the bones of the hands and feet apear normal.

Burial C

Campo Santo Burial C, of October 1967, is a young adult female in generally excellent condition, lacking feet and fibulae (except for the distal half of the left fibula); otherwise the only bones missing are the hyoid and coccyx, probably a few ribs, the patellae, some carpals, a metacarpal, and 19 of the 28 phalanges of the hands. The pubes, the right scapula, and several ribs are badly damaged. Less seriously damaged are the left scapula, a couple of ribs (17 unbroken), the distal end of the left ulna, and the lateral end of the clavicle. Catalog number: Q/5010/37.

Age at Death

Burial C was close to 21 years old at time of death. The third molars are up but unworn, and tooth wear is generally not severe; no teeth were lost. The basi-sphenoidal "suture" or synchrondosis is closed. The lateral epiphyses of the clavicles are apparently completed, but sternal epiphyses is definitely not, with no beginnings of union showing. All long bone epiphyses are joined, with no lines of union remaining clearly visible. There is a line showing between the first and second segments of the sacrum. The iliac rims are fairly recently on (the line of union is clear on each interior surface), and the ischial tuberosity is not yet joined, at least on the left and seemingly on the slightly damaged right ischium.

Cranium

Occipital deformation is almost vertical, between slight and moderate in degree, with no asymmetry. The occipital torus is inconspicuous—a small, very low mound. Sutural complexity is comparatively low in the lambdoid suture, but moderate in the sagittal and coronal sutures. There are a few quite small Wormian bones. The pterion is in a narrow "H" on the left, with a small epipteric bone on the right side. There is only one parietal foramen, on the right side of the obelion. The mastoid processes are small, with undeveloped supramastoid crests. There are no dehiscences, no pharyngeal fossa, and no precondylar tubercle.

Frontal height and fullness are medium, without development of distinct frontal bosses. A slight glabellar prominence expands laterally as very low, small brow ridges. The supraorbital foramina are quite small, and the orbits are rhomboid and moderately inclined. The malars are quite prominent, medium-sized, and with a slight development of zygo-maxillary tubercles. A fairly prominent nose has a concavo-convex profile, rather broad nasalia, and a very slight nasal overgrowth; the nasal spine is small or (for a female) medium. The infraorbital foramina are rather small, with decidedly concave suborbital areas. The alveolar prognathism is moderately pronounced.

Mandible

The mandible, medium-sized and moderately strong, shows a strong prominent chin of median type, with no gonial eversion. There is evidence of a few caries—a distinct, small cavity has already appeared in the lower left third molar.

Thorax

The sternum is medium in size and the manubrium is united with the gladiolus. The ribs seem unremarkable.

Shoulder Girdle and Pelvis

The shoulder girdle and pelvis are of interest primarily in connection with sexing and aging. No special features are noted, except that the suprascapular notch is negligible on the left scapula, and undetectable on the right.

Spine

The normal spine includes the five-segment sacrum, and exhibits such minor discrepancies (not unusual) as differences between the right and left costotransverse foramina of the sixth cervical. The tenth thoracic has faint but recognizable facets on the transverse processes, and the body of the ninth has very small demifacets below on each side, as well as the normal demi-facet above for each ninth rib.

Bones of the Arm

The arm bones are of medium size and muscularity, showing no septal aperture of the humerus or other special features.

Femora

The femora are slender, with no pilastering and no third trochanters.

Tibiae

The tibiae are of moderate stoutness and show only the slightest concavity of the lateral (external) surface, and are roughly almond-shaped in cross section. There is little or no retroversion of the tibial heads and no squatting facets.

Burial D

Campo Santo Skeleton D, collected in July 1968, is a mature adult female specimen in generally very good condition. Only the coccyx, one wing of the hyoid, several carpals and most of the smaller tarsals, the metatarsals, and the phalanges of the feet are missing entirely. Moderately or severely damaged are the left innominate, the left scapula (not badly, and the right only slightly), and several ribs.

Cranium

Undeformed, the cranium has fairly well-developed parietal bosses and is pentagonoid in the norma verticalis. There is a strong, mound-shaped occipital torus. Sutural complexity is fairly high, but there are no Wormian bones, the pterion is in a medium "H." A single parietal foramen occurs on the right. No pharyngeal fossa, no dehiscences of the tympanic plate, or other anomalies are noted.

Frontal height and fullness are below medium, with brow ridges quite strong for a Pueblo female. There is a supraorbital foramen on the left, but only a notch on the right side. Although the zygomatic arches are prominent, the malars are quite small. The suborbital concavities are deep, especially on the left. The nasal skeleton is prominent, and concavo-convex. Alveolar prognathism is moderate.

Mandible

The mandible is fairly strong and of a moderate size, with a median chin and a very slight eversion of the gonial angles.

Dentition

Tooth wear is moderately severe, and a large cavity appears on the buccal side of an upper premolar. The teeth were not crowded. Pre-mortem losses include the lower, the right first and third molars, and (if it had erupted, as looks probable) the left third molar, as well as all upper molars, the upper left second premolar and possibly the right, and the upper right central incisor.

Thorax and Shoulder Girdle

The sternum is normal, with a small gladiolus that is not perforated, a separate manubrium, and no xiphoid ossification. The ribs and clavicles are unremarkable. The scapulae are normal, with a well-developed suprascapular notch on the left but none (or a trace, barely detectable by touch, not observable to the eye) on the right.

Pelvis

The pelvis is mature and distinctly female. The right face of the pubic symphysis appears to be in Stage VI—that is, age between 27 and 35 years at death (other indications fit this classification quite well). A normal five-segment sacrum is smallish, and slightly curved, with probably a little more curve than the typical or average female.

Spine

Some osteophytosis (presumably arthritic) appears on the third and fourth lumbar vertebrae, and very slightly on the first and second lumbars and fifth through twelfth thoracics (more notable exostoses can be seen on the seventh and eighth thoracics, left side only). There are no articular facets on the transverse processes of the tenth and eleventh thoracic vertebrae.

Arms

The muscular development of the humeri is notable. In the right humerus the septum between the olecranon fossa and the coronoid fossa is not perforated, but the left humerus has double aperture—a medium-sized medially, in about the normal place, supplemented by a tiny accessory perforation a couple of millimeters to the left (laterally). This form of the not uncommon septal aperture of the humerus is a variation I have not seen before or come across in the literature. The bones of the forearm are normal and quite muscular.

Legs

The femora are slender, with a little development of pilastering along the linea aspera. There is some "arthritic" osteophytosis on the rim of the head of the right femur. The tibiae are flattened anteroposteriorly, but not excessively so. They are not "saber-shaped," but with a Type III mid-shaft cross section (roughly almond-shaped with concave external, i.e., lateral, surface). Squatting facets are not clearly defined, and retroversion of the tibial heads is only slight. The fibulae are unremarkable. The superior portion of the lateral (external) border of the patellae is deeply concave.

Burial E

Campo Santo Skeleton E, collected in July 1968, is an adult male specimen in generally quite good condition. Only the hyoid and coccyx, two carpals, five left tarsals, all metatarsals except the left first, and most phalanges are missing entirely, but both innominates, the distal end of the left radius, the heads of both tibias, the right fibula, and a number of ribs are seriously damaged.

Cranium

The undeformed cranium is a long oval in shape; the parietal bosses are undeveloped, and the occiput is somewhat protuberant. The occipital torus is medium-sized and mound-shaped. Sutural complexity is high; there are several Wormian bones, including a symmetrical one at lambda with a horizontal lower border that might easily be referred to as a very small Inca bone. The pterion, which is in a rather wide "H," has a small epipteric (?) bone on the right like a separate segment of the right temporal (not reaching the frontal). The basioccipital synchrondrosis is apparently not closed, but this is contradicted by other indications of maturity throughout the skeleton. No anomalies are noted in the cranium.

The frontal is narrow and retreating, with no development of bosses, but with prominent glabella and strong median brow ridges. Instead of supraorbital foramina, there are very shallow inconspicuous notches. Malars are large and prominent, but not sharply angulated and with little development of tuberosities. The infraorbital foramina are large, and the suborbital areas only very slightly concave. The nasal skeleton is medium-sized and fairly prominent—concavo-convex in profile. Alveolar prognathism is between moderate and slight.

Mandible

The mandible—stout and medium-sized has a square chin (medio-bilateral) and some gonial eversion.

Dentition

Tooth wear is only moderately severe. Some little caries can be seen, plus apparently a very big cavity in the lower left first molar. There is no crowding in the mandible, but the upper left lateral incisor is partially rotated. Pre-mortem losses include the lower right first and second molars, and both (probably) upper third molars.

Thorax and Shoulder Girdle

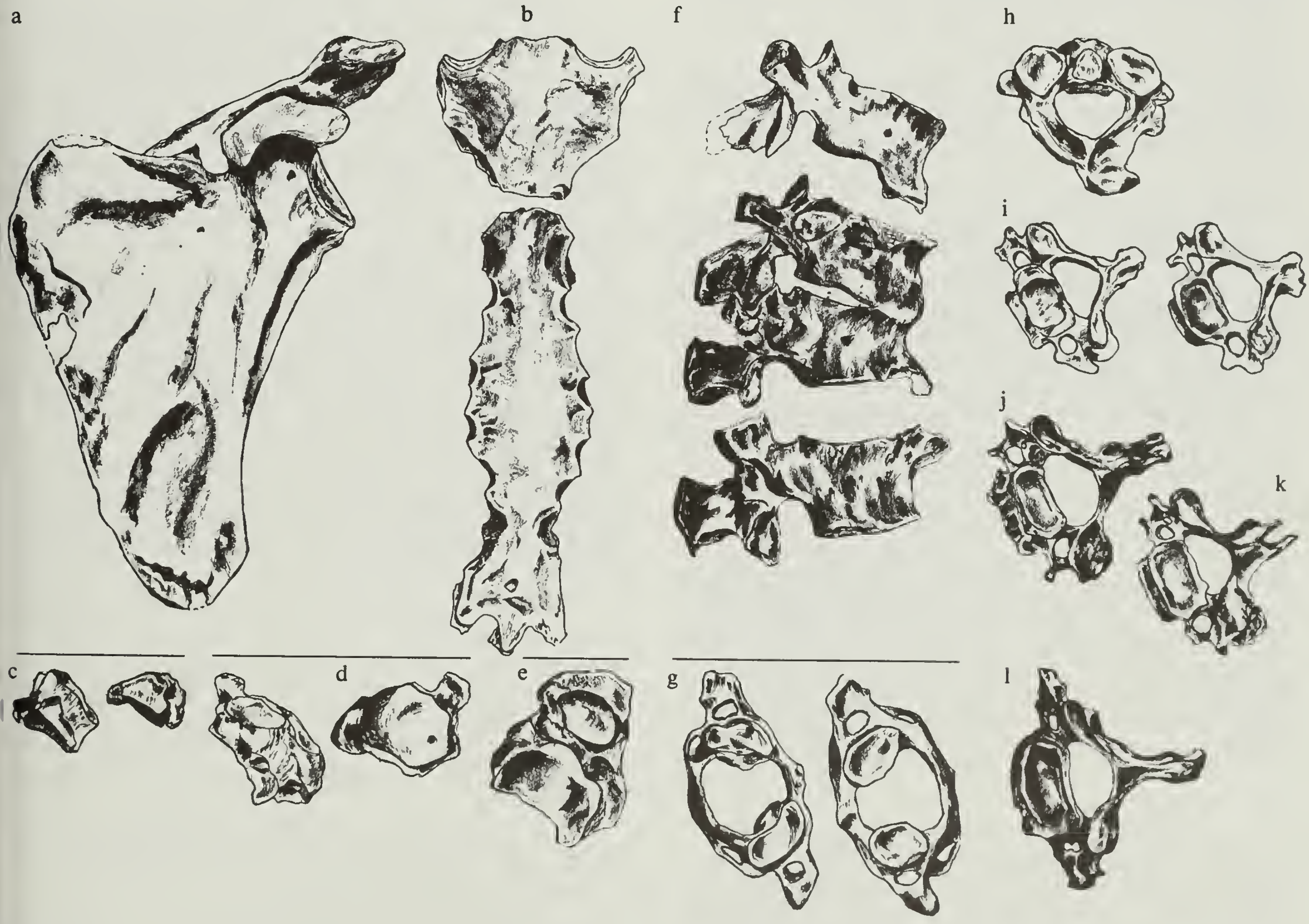
The sternum is fairly large, with the manubrium separate but ossified and the xiphoid united (fig. 71), with a foramen in the latter (but none in the gladiolus). A very slight ossification of cartilage can be seen on the sternal ends of the first ribs. The clavicles are less marked and roughened by muscular insertions than is typical. The scapulae, unusually well preserved, both have deep semicircular notches, with small projections as of partial bridging on the right (no such tendency shows in the left scapula).

Pelvis

The pelvis is mature and obviously male. The pubes are badly damaged, and the symphysis is missing. Other age indicators – throughout the skeleton generally – suggest a developmental stage comparable to Burial D. The normal 5-segment sacrum is well curved.

Spine

The lower three lumbar vertebrae and the base of the sacrum are without any osteophytosis. There is just a little growth on the left half of the upper margin of the second lumbar; the first lumbar has a large osteophyte, and the lower and central thoracic vertebrae show a good deal of osteophytosis. The last three thoracic vertebrae, in fact, are fastened together by ankylosed exostoses covering portions of the anterior margins. The next three (seventh, eighth, and ninth thoracics) do not have any osteophytes. The fifth and sixth thoracics are like the lower ones, with osteophytes at the same location – on the superior margin of the sixth and inferiorly on the fifth, matching but not actually fused (as with the twelfth thoracic and first lumbar). The first four thoracics, again, are not



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71. *Campo Santo* Burial E.

involved, but there is a little exostosis on the seventh cervical and a bit more on the sixth.

Additionally, the left superior articular surface of the sixth cervical and the left inferior one of the fifth are overgrown or expanded or splayed out and porotic (as in two pairs of cervicals in Skeleton A and, more extensively, in the spine of Skeleton B). The third and fourth cervicals appear to be normal, or at least not pathological—the spinous process is not bifid in either of these (or in the sixth, as well as the seventh); only the fifth cervical has a bifid spine.

In the second cervical the spinous process is wide, flat, not bifid, and highly asymmetrical, or as if displaced to the right side. Finally, the first cervical presents a notable case of complete "bridging of the atlas"—a process or spicule or ponticulus (anyhow, a narrow, little, thin strip of bone) going across the area of the vertebral artery on each side, from the posterior side of each superior articular facet backward and down to the lamina. This not uncommon anomaly is not considered pathological, but apparently is simply a hereditary variation (Selby, Garn and Kanareff, 1955), so this instance presumably has no relationship to the considerable pathology below it in the spine of Burial E.

Arms and Hands

The humeri are medium to slender, with no septal perforation. The normal ulnae and radii are slender and muscular and there is nothing to suggest osteoarthritis at the wrist or elbow.

Legs and Feet

The femora are normal, with only a very slight tendency to pilastering along the linea aspera. Only the tiniest of exostoses, barely noticeable, can be seen in the trochanteric fossa of the right femur, but none is observable in the left. The tibiae are normal, Type III with pronounced concavity, and no special features. The fibulae are also normal, with a very small osteophyte depending from the medial side of the head of the left fibula.

At least three of the nine tarsal bones present have peculiar features. The right astragalus (talus) has a malformed or destroyed anterior calcaneal facet and a peculiar little ridge in the groove behind the middle calcaneal facet, with a presumably abnormal pit behind that. A few details of the right calcaneum, such as a ridge beside the anterior articular facet, correspond to the peculiarities of the talus; there is a small osteophyte on the posterior surface, near the place of attachment of the Achilles tendon. The right navicular (scaphoid) has a relatively large osteophyte and small additional exostoses. The right second cuneiform has an exostosis meeting and matching the big one on the scaphoid. The other two cuneiforms and the cuboid seem uninvolved. The left calcaneum and talus are normal (other tarsals were not present).

Burial i

Campo Santo Burial i was collected in July 1968. It consists only of a cranium, fully adult but fairly youthful, and very probably female. There is pronounced occipital deformation at an angle close to vertical; it is highly asymmetrical, with much greater compression on the left side. The occipital torus is well developed (a broad mound). Sutural complexity is moderate—quite low in the right half of the lambdoid suture—with a few small Wormian bones in the left half of the lambdoid suture, and with a large one below the left asterion and other intersutural bones along the posterior portion of the squamoparietal suture. The pterion is in a narrow "H," seemingly fairly normal on the left, but it looks peculiar on the right—the situation is obscured by damage and cracking on both sides. A pair of parietal foramina were observed, but no anomalies.

The frontal height and fullness are only moderate, but with distinct frontal bosses. Although the brow ridges are very small, the glabellar prominence is strong for a female. Supraorbital notches are well marked. The malars are rather small, but prominent. There are large infraorbital foramina over deep canine fossae (suborbital concavity). The nasal skeleton is prominent, concavo-convex, with a very slight tendency to nasal overgrowth. Alveolar prognathism is pronounced.

Upper Dentition

There were no pre-mortem losses, no readily observable caries, and only slight wear—except close to moderately severe on the right first molar only; neither is there crowding, but the left second premolar is rotated (a full 90° turn).

Summary of 1967-1968 Material

Of the six adult skulls (two male, four female), three are undeformed. Females B and C have moderate occipital deformation, close to vertical without any asymmetry, and cranium i has pronounced and highly asymmetrical occipital deformation (again belonging in the vertical category, although a few degrees off).

Only cranium i might be considered a Southwest Plateau Ashiwid, but even this one looks untypical. The others fall in the non-Southwestern category, resembling Plains material and the Oramid type, with little suggestion of any Deneid (northern, largely Athapaskan) element as such.

Male A has a true *os inca*, an interparietal bone divided occipitally (that is, a horizontal suture from asterion to asterion) —the only one found at Las Humanas. Male E has a fairly symmetrical Wormian bone at lamda, such as is also called an *os inca*. Cranium i offers the rather unusual combination of several Wormian bones, largely concentrated around and above the left asterion, with quite low complexity of the lambdoid suture.

There seem to be dehiscences of the tympanic plate in skull B. Skull C has a small epipteric bone on the right side only, and E has a somewhat similar condition. The pterion arrangement on at least the right side of cranium i apparently resembles that of E.

In the post-cranial bones of Campo Santo burials A through E, the following items are of interest: a sternal foramen (apparently, but uncertain) in the gladiolus of A (mature adult male); the manubrium not joined in A, B, D, and E (but united with gladiolus in 21-year-old C), and an ossified xiphoid, with foramen, in E. The suprascapular notches are normal and semi-circular in A, E, and the right scapula of D, but imperceptible or almost so in B, C, and the left scapula of D.

A five-segment sacrum occurs in A, C, D, and E, while the coccyx is incorporated with the sacrum in B. An osteophytic projection appears on the right ilium of A.

Notable bridging of the atlas is seen in E. Osteophytosis, or porosis and exostoses, is found in the spine in A, B, D (slight), and E (notable, with ankylosis of the lowest three thoracic vertebrae).

While no septal aperture (olecranon perforation) of the humerus is seen in A, C, or E, various forms thereof do appear in B and D—with D showing the unusual condition of a double perforation in one humerus (the left), and none in the other.

Osteophytes on the leg bones and/or tarsals are evident in A, B, D, and E, the last with quite unusual peculiarities of several of the tarsals of the right side.

Reconstructed statures estimated at about 165 cm. (5 feet 5 inches) for two males and between 154 and 157.5 cm. (5 feet 3/4 of an inch to 5 feet 2 inches) for three females are very normal, close to the means of the Mound 7 series. The claviculo-humeral index is likewise typical in this group.

Discussion

In the first place there seems to be unusually little in the way of pathological features and anomalies in the 1956 collection. The apparent prevalence of young adults helps to explain the low incidence of arthritic (?) exostoses or other osteophytosis. Aside from dental pathology (less than usually encountered), the only definite pathological features are button osteomata on the forehead of skull #12, and hemotomata of a pair of tibiae and of ulna #124. Anomalies not necessarily pathological include a four-segment sacrum, one six-segment and a probable second (a not infrequent condition in Southwestern material–see Reed, 1967), and two left humeri with supratrochlear perforation (a low incidence for this phenomenon in Southwestern material). Similarly, the youthful individual of October 1967 is without pathology and peculiarities.

Cranial deformation (artificial, from use of cradleboards) has already been discussed, and is a difficult problem here. However, incorporating the 6 adult skulls collected later in the categorization of the 1956 crania increases the undeformed group to 11 and the vertical deformation category to 8 (with 2 of them pronounced in degree).

As to racial type and affiliations, this group is somewhat confusing and does not seem unitary. Male specimens #5 and 15, which have large crania with retreating foreheads, prominent facial features, and leptorrhine nasal skeletons, accompanied by strong mandibles with gonial flare (slight in #5, pronounced in #15 to a degree rarely seen in the Southwest), have a general "Plains Indian" look. Specimens #13 (possibly female) and #19 (probably male) also look un-Anasazi, and the long narrow nasalia and general appearance suggest comparison to the Deneid type. In preparing Table 42, I computed means for the male group without these four; the differences were negligible, except in the nasal index, where it was 2½ points higher without these four). But in Table 47, I have listed the four separately, with non-Southwestern comparative material (either Deneid or with an evident relationship to that group, type, or variety).

While the collections from Las Humanas and Pueblo Pardo as a whole fall metrically within Southwestern ranges in general, and largely close to Pueblo means (in several instances closer to Hawikuh than to Pecos), these four individuals (#5, 13, 15, and 19), and possibly others, correspond better to the Deneid series, it seems to me, than to the Southwestern groups in certain respects, at least in nose length and nasal index.

Quite possibly these crania actually do represent Apaches, who traded and visited frequently at Las Humanas in the 17th century, or individuals of part-Apache parentage. No other Plains group is a likely source for the non-Southwestern element here at this period, although one of the Wichita tribes (to whom the name "Jumano" was applied in the following century) is not out of the question.

The possible comparison to the San Simon type of southern Arizona that I rather tentatively offer in discussing Pueblo Pardo material does not hold up for Las Humanas, where no perceptible median frontal cresting or notable saggital elevation have been observed.

Differences from Anasazi and other Southwest Plateau material seem to be minor, and presumably these collections in general are to be considered–except for a possible Plains Apache element–as falling in the Southwest Plateau (Ashiwid) category, with minor local or individual variations and discrepancies. Distinctions for Las Humanas include, as stated earlier, lack of pilastering of the femur and of squatting facets on the tibia; rarity of septal aperture of the olecranon fossa of the humerus; generally low sutural complexity with few Wormian bones; and, much less consistently, retreating or narrow foreheads and concave nasal profiles.

Material from Pithouse Excavations

In the summer and fall of 1964, Park Archeologist Douglas Scovill and Ranger-Archeologist Ronald J. Ice (Ice, 1968) excavated two pithouses in the residential area of Gran Quivira National Monument. Both are characterized by Chupadero Black-on-white, with a little St. Johns or Heshotauthla Polychrome, but no Rio Grande Glaze-paint ware (placing the occupations close to A.D. 1300). Each yielded one inhumation burial, in very poor condition.

GRQU-2 (Burial 1)

This is an adult female, fragmentary and highly incomplete. All that remains of the skull is the left horizontal ramus of the mandible (which is small, suggesting also a small and sloping ascending ramus, and a small median chin; there is a very slight trace of gonial eversion, and the premolars and first molar were apparently lost pre-mortem), a medial fragment of the right maxilla (showing rather severe tooth wear and a doubly-shoveled incisor; a suborbital fossa, at least slightly concave, is definitely suggested), and a couple of small pieces from the squamous portion of a temporal.

The arms are represented only be the shaft of a curved, muscular, right ulna.

The femora are slender, with slight but definite pilastering, with no third trochanters; they are approximately 41 cm. in bicondylar length (the distal epiphyses are gone on both), and the head of the right femur is 40 mm. in diameter.

The tibiae are slender and Type II (concave external surface), with some retroversion of the head. The distal epiphyses are missing. The length must have been somewhere between 33 and 36 cm. The shaft of one fibula is present. The calcanea are good-sized for a Southwestern female.

The stature would have been in the neighborhood of 156 cm., or between 61½ and 63 inches.

GRQU-14 (Burial 1)

This skeleton of a quite young adult female is fragmentary, damaged, and incomplete, but in much better condition than the GRQU-2 skeleton. There are conflicting indications of age, from about 16 years to just over 20, with the preponderance of evidence favoring the latter (the femora and sacrum are completed, and the iliac crest is not yet joined, but a couple of metacarpals appear to lack the distal epiphyses).

The cranium is small, gracile, and rounded, with occipital deformation at an intermediate angle closely approaching lambdoid, between slight and moderate in degree, with no asymmetry and not forming a sharply defined flat plane. Other characteristics include a small occipital torus (ridge-shaped), low sutural complexity, and several small Wormian bones.

The mastoid process is quite small, although the supramastoid crest is well developed, with a typical single retromastoid foramen on the right (the left temporal is missing). There is no sagittal elevation or median frontal cresting. The frontal is normal and moderately low, showing no development of frontal bosses. The minimum frontal diameter is close to 90 mm. The frontal has a very slight glabellar prominence, small medial brow ridges, and a supraorbital foramen on the right (but only a notch on the left). Although there is no nasion depression, the nasal root is high and wide.

The remaining bones of GRQU-14 can be briefly noted. A large sternal foramen, for example, is evident in the gladiolus. Although the fragments of the ribs and vertebrae are unremarkable, those of the pelvis indicate that the individual was youthful and definitely female; there was evidently a normal five-segment sacrum. The arms are represented only by the proximal two-thirds of the right ulna. The femora are long, slender, normally bowed, and strongly pilastered. The right femur is approximately 385 mm. long (bicondylar), and the diameter of the head is 40 mm. (the head of the left femur measures 41 mm.). No third trochanters are evident. The right tibia is between 31 and 33 cm. long and flat-bladed—a slender Type III (concave external surface), approaching saber-shaped. The head is retroverted. The stature of this individual would have been about 151 cm. (4 feet 11½ inches).

In addition, test excavation in the residential area by Park Archeologist Richard M. Howard, in 1960, exposed a clay-lined pit in which he found a number of human bones, designated as "RA burial." Actually, these represent more than one individual, all fully adult, all in poor condition, as follows:

1. Skull: a restorable mandible, small and feminine, with small but prominent bilateral chin, with no gonial flare, and good teeth—no caries, no pre-mortem loss, and only moderate tooth wear; most of the left maxilla corresponding excellently to the lower jaw.
2. Pelvis: fragments of three innominates (no two corresponding, representing two male-sized acetabula), and another right, phenomenally pathological (see discussion by Thomas W. Mathews below, and fig. 72).
3. Arms: a pair of moderate-sized humeri and an extra left that is slightly longer and more slender (none perforated, and all with heads gone), and a small and youthful right ulna and radius.
4. Legs: slender right femur, only slightly damaged, a little over 410 mm. long, the head close to 40 mm. in diameter, and the distal half of a closely corresponding left femur; also the proximal half of a much smaller left femur, possibly sub-adult; most of a left tibia and two pieces of the shaft of a fibula, both of a size to go with the pair of incomplete femora.

All this material has been discarded except the mandible and the remarkable fused hip-joint (catalogue number 2/4443/37).

This specimen is so extraordinary that, having put it aside after one horrified glance for a later look, when I did so I could not believe it, and thought it could not be human. It was submitted to Thomas W. Mathews of the National Park Service Southwest Archeological Center at Globe, Arizona, who reported as follows:

> . . . it is also human, and one of the most severe examples of bone pathology I've seen. It is the fused right innominate *and* right femur of an adult. The femoral caput is fused into the acetabulum and surrounded by masses of osseous outgrowth.
>
> Part of the iliac blade is present minus the crest; the greater sciatic notch is present and free; the right auricular scar for attachment of the sacrum is observable; and part of the superior ramus of the pubis is present but is much thickened with piled up bony outgrowth of the body and lateral portion.
>
> The body and a portion of the superior ramus of the ischium, including part of the border of the obdurator foramen, are present. The neck of the femur is relatively normal; both trochanters are missing. The shape of greater sciatic notch and the size of the femoral neck suggest an adult male.
>
> There are several extra foramina present, due, perhaps to encasement of nerves, blood vessels, or insertions for muscles in bone tubes or straps. The two most prominent of these are: one through the upper edge of the superior ramus of the pubis near the attachment for the pectineous; the second pierces the ilium near the border of the greater sciatic notch and opens on the exterior surface of the iliac blade in the vicinity of the inferior gluteal line. Both openings (internal and external) have well-defined deep fossae extending from the foraminal apertures.
>
> On the ilium, directly adjacent to the auricular scar, is a deep and wide fossa running vertically up the interior face of the blade. The surface of this depression or trough shows a fine washboard texture of osseous growth. The entire blade is much thickened and presents a bi-convex or lenticular cross-section. The normal iliac blade at this level is strongly concavo-convex or S-shaped in section. One of these fossae, that through the pubis, could very easily be the result of a spear-thrust or other weapon.
>
> All of this suggests severe traumatic injury to the right hip joint of this individual, followed by extensive repairatory changes in the acetabular region—followed by healing of affected area; but the suppurative lesions aspect is not particularly persuasive, although one tunneled hole through the acetabular border and femoral head may be a drainage cloaca, if it is not post-mortem in origin. There are, however, open channels leading from both the false foramina and deep iliac fossa which are pathological in origin.
>
> One interesting observation is the extremely thickened iliac blade. With immobilization of the hip joint the entire weight-bearing and stressing of the pelvic region changed from transmission of thrust through the innominates and sacrum to the legs via the acetabulum-femoral caput and neck to weight-supporting by the damaged innominate and femur; the greatly thickened iliac blade probably taking up the load. Oddly enough, there seems to be very little displacement of the femoral head in relation to the acetabular socket, but some rotation forward and laterally may be present (memorandum of 18 January 1967 to Alden C. Hayes).

There is one comparable item on record from the Southwest, a fused hip from Wupatki, which is analyzed as representing ankylosis due to an infection (Jarcho, Simon, and Bick, 1963).

Skeletons from Pueblo Pardo

The small collection of human skeletal material reported upon here derives from archeological excavations during the summer of 1941 at Pueblo Pardo (LA:83), a large Pueblo IV ruin across the valley south of Las Humanas. Occupied in the 14th to 17th centuries, it is characterized by Chupadero and Tabirá Black-on-white, plain smooth gray culinary pottery, and small amounts of intrusive Rio Gande glaze-paint ware of all horizons, Glaze A to Glaze F, inclusive (Toulouse and Stephenson, 1960). Thirty-six burials were found, including seven cremations, in the 1941 excavations.

The bones were originally sent to Georg Neumann, but he was not able to complete their study and write a report at the time, and returned the collection after having, evidently, gone over it in preliminary fashion. In the custody of the National Park Service for almost 20 years, at Gran Quivira National Monument, and then at the Southwest Regional Office in Santa Fe, the material was finally turned over to the Museum of New Mexico.

Specimens being retained have been assigned catalog numbers 17084/18 through 17098/18. I studied this material during the winter of 1961-1962, and in February 1963, while writing up this report, again reviewed the specimens not already discarded. Very little editing and adding to the manuscript was done over the ensuing three years, with final revision in September 1966, upon deciding to combine it with reports on Las Humanas material instead of publishing it separately.

The series comprises seven adult skeletons (five male, two female) and a 17-year-old male, two 14-year-olds (probably male), and a child about 9 to 10 years old (believed to be female), all in fairly good state of preservation and completeness. Also included in the series are 15 infants and 7 cremation burials. The cremations and several of the small infants were discarded after examination during 1962. Four adult skeletons originally listed as recovered in the Pueblo Pardo excavations are missing—Burials 1, 2, 27, and 29 (Toulouse and Stephenson, 1960, fig. 42, p. 35). In a letter of 26 January 1965, Toulouse informed me that all four were highly incomplete and in very poor condition, and hence were not retained.

The cremations yield very little information. Three were adults, one a small adult or an adolescent, and one a child; two others, consisting of small bits, were entirely uncertain. I have been unable to determine cranial deformation, or learn anything else, from these calcined fragments.

Seven unburned inhumations (#3, 4, 11, 17, 18, 19, and 25) represented newborn or stillborn babies, possibly including premature births and/or 8-month fetuses, with femur lengths of 65 to 80 mm. The eight other infant burials include two in the first year of life (#323 and one of two buried together, #22), a 2-year-old (#26), three 3-year-olds (#20 and 31, and the other #22), a 4-year-old (#14), and a 6-year-old (#10).

The two 14-year-olds are #5 (fairly definitely male, just about 14, and in fairly good condition), and #13 (between 12 and 14 years old, but sex not at all certain). Burial 5 and the 17-year-old male, #36, are included in the tabulation of males (for observations, not for measurements and indices), along with #13 (only for certain features). The 9-year-old female (?) child is #34.

Artificial Cranial Deformation

The infants either clearly have no artificial (cradleboard) occipital deformation, or else show uncertainly, dubiously, very slight lambdoidal flattening—except in the case of #20, which shows more definite and surely artificial deformation, but not much compression in comparison to typical Anasazi material from the San Juan region.

Burial #34, the 9-year-old, manifests definite though slight deformation, notably asymmetric to the left side, and at a high oblique angle—the lambdoid type but affecting only a laterally narrow area.

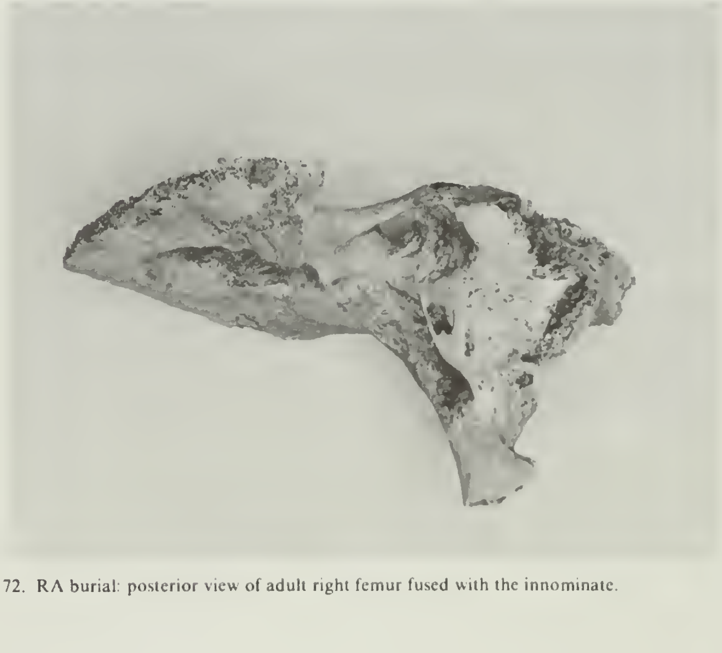
Four adult males (#15, 16, 30, and the 17-year-old, #36) and one adult female (#32) are undeformed. Three adults (males #9 and 33 and female #12) and the 14-year-old male (#5) show vertical occipital deformation, slight or moderate (very slight in #5 and 12), that is asymmetric in all cases.

The other 14-year-old (#13) shows very slight lambdoidal flattening, quite possibly not artificial. Probably this, and the small children with slight and questionable deformation (except for #20), should be considered as essentially undeformed—the flattening, if artificially caused, certainly does not represent whatever peculiar kind of cradleboard or accessory device produced the remarkable high-angle pronounced deformation of the true oblique lambdoid style which is one of the distinct features of the San Juan Anasazi group (Reed, 1949, 1963c; comments and map in Snow, Ms.).

Consequently, then, the Pueblo Pardo collection includes a dozen undeformed crania, only four with vertical occipital deformation (moderate to slight, asymmetrical) and two (#20 and 34) with a variant of lambdoid flattening. That observed on #13 is very possibly of natural origin. A few of the small children, as well as the presumably newborn babies, and the cremations, are not included in the above figures. Such a high proportion of undeformed skulls—also found at Las Humanas nearby—is unusual and surprising for the Rio Grande area in Pueblo IV times.

Natural Cranial Details

Traits shared by the adults and by juvenile males #5 and 36 include: moderate or submedium occipital torus and low nuchal muscularity in general, occipital protuberance (especially in undeformed crania, naturally; quite notable in #36—comparable to Rosa



72. RA burial: posterior view of adult right femur fused with the innominate.

Phase crania from northern New Mexico such as #17100 and 16767-769, cf. Reed, 1963b); mastoid processes of moderate size (quite small in the females), pterion in an H-arrangement (the normal thing), low frontal height and sub-medium fullness; no actual nasion depression, prominent fairly well-arched nasal profile (concavo-convex nasalia, without overgrowth except in one case, female #32), nasal spine moderately strong in males, small but definite in both females and the 14-year-olds; and orbits of rhomboidal "rounded-square" shape (squarish but with rounded corners), and fairly large infraorbital foramina.

Sutural complexity varies: three are low, four moderate, and three high (adult female (#32 and both of the 14-year-olds). Seven of these 10 have no Wormian bones, but one of the 14-year-olds has several, and one female and one male have a few. The supramastoid crests are well-defined, but no particularly strong, on one adult male, on a 14-year-old, and on a female; they are negligible on the others.

Glabellar prominence is only very slight in almost all—moderate on #15 and comparatively quite strong on #16, and moderate for females on #12 and 32. Brow ridges are very slight or absent on females, 14-year-olds, and the 17-year-old and four other males, but rather strong on male #16, of central but interrupted type (extending above the inner half of each orbit), along with moderate glabellar prominence. Not particularly different otherwise from the rest of the males, #16 must carry a strain of the Ainoid or "pseudo-Astraloid" element of the Southwest Plateau type (see Reed, 1956, 1962b, p. 243, 1963a, Mss.).

Other features that vary somewhat include the nasal root –it is high and narrow in three (males #15 and 16, and #13), moderately so in seven (adult males #9 and 33, juvenile males #5 and 36, females #12 and 32, and juvenile female #34), and rather wide and low in male #30. The inclination of the orbits is very sloping in males #5 (juvenile) and #9, moderately so in female #12, and only slightly sloping, or virtually not at all, in eight (males #15, 16, 30, 33, and 36, adult female #32, and juveniles #13 and 34). Alveolar prognathism does not exist in male #9, but is slight in female #12 and juvenile #34, moderate in four males (#15, 16, 33, and 35), and marked in four (#5, 13, 30, and 32).

The malars are generally prominent and moderately large, but with noticeable variation–large in males #5 and 9, rather small in males #30 and 36, and notably prominent and angulated in juvenile male #5. Additionally, however, #5 has a horizontally divided malar: an "extra bone"–known as the *os japonicum*–formed by an unusual suture separating the postero-inferior, or masseteric border, from the upper portion. A similar condition occurs on a skull from Las Madres (LA:25) in the Galisteo Basin (Reed, Ms. a).

The suborbital fossa of the maxilla is concave and slightly but definitely excavated in the six males, including 17-year-old #36, and in the 12- to 14-year-old, #13; it is not at all so, however, in the two adult females or in juveniles #5 and 34.

Mandibles present have square and strong or moderately prominent chins of median type. Gonial eversion occurs–slight but definite or moderately pronounced, and not markedly flaring–in all adults except one female with incurved gonial angles, #34 (also none in juvenile #34).

Adult dentitions are characterized by moderately to extremely severe tooth wear, shovel-shaped incisors (in all four observable adult cases and also in the four juveniles aged 9 to 17 years), very little caries, and not much pre-mortem loss (none in #15, 32, and 33; one molar in #12; three molars in #30; five molars and four upper incisors in #9; and three lower incisors and the lower second and third molars, the left central upper incisor, the upper premolars, and three upper molars in #16).

The third molars of #32 (female, about 20 years old) are notably reduced in size. No third molars seem to have ever been present and erupted in #12 (female, 22 to 24 years old), and none except a small and crowded upper right appear in #33 (male, just about 21 years old). In the 17-year-old male, #36, the right third molars had begun to come in. The left ones are present but not erupting yet.

Discussion of Affiliations

Neither the observations noted above nor the dimensions and indices given in Table 48 differ as much from the Southwest Plateau type in general, and from San Juan Anasazi crania in particular, as do the visual impressions from superficial inspection (compare the illustrations herein of Pueblo Pardo skulls with plates in the references on material from the upper San Juan).

The general effect of many of these individuals is of a long, low-vaulted, narrow skull with protuberant occiput and with a notably low and constricted frontal. They do not, however, seem to correspond particularly to the early or peripheral very dolichocranial type or types exemplified by Texas Gulf Coast "Otamid" material. The Pardo material can probably be regarded as representing a variation of the Southwest Plateau type (Seltzer, 1944), the local form of the widespread Ashiwid variety (Neumann, 1952), possibly with an Otamid infusion from the eastward, or, more specifically, an Apache element (see discussion of Las Humanas material). Not consistently and markedly different from Basketmakers, this and other southern material nevertheless diverge somewhat from the normal Anasazi type. Comparison with the San Simon type of southern Arizona is suggested by certain traits of a few skulls.

The protruding occipital bun in the undeformed Pardo crania seems exaggerated in comparison with my impression (no direct comparison made to actual skulls) of San Juan Basketmakers and other undeformed Anasazi, but this may be due to my having become accustomed to handling deformed material far more frequently. In any case these appear definitely prolonged posteriorly, especially when viewed from below. The figures in Table 48 for glabella-inion length and cranial index come out very dolichocranial (though within Pecos ranges) because of the extreme narrowness and considerable length of #36; if this cranium had not been recovered, or had been too badly damaged for measurement, this little collection would seem to be metrically pretty typical Pueblo except around the eyes and in vault height and frontal breadth.

The closeness of correspondence in most items to male Pecos and Hawikuh (undeformed) means, in fact, is quite surprising –for example, in regard to overall length, bizygomatic diameter, face heights and facial indices, maximum nose dimensions and nasal index, mandibular breadths, and symphysial height. Divergence appears in the low vaults and narrow foreheads of males (the minimum frontal diameter of #16 being right at the bottom of the Pecos range, with none exceeding the Pecos *average* and only #33 approximating it), and in the notably hypsiconch orbits in both sexes.

In the Southwest Plateau type generally—in San Juan Anasazi of A.D. 300-1300, in most Rio Grande Pueblo IV series such as Pecos and Paako, and in other Southwestern material—the modes are: orbit height 34-35 mm., dacryal breadth 38-40 mm., and mean orbital index around 90 mm., within three or four points each way (high mesoconch—very low hypsiconch). Of the six Pueblo Pardo males, all but two are above the Pecos average for this ratio, only one is really below it, and two, with a mean orbital index of 100, exceed the maximum of the Pecos *range*. The orbit height in #9 exceeds the Pecos range for that dimension, in fact, although matched (for the left orbit only) at both Hawikuh and Paako, of which only the former yields indices of 100 or over.

Other male crania from the Southwest with reported orbit heights of 38 mm. or over, or indices over 95, or both, include: Winona, Arizona, NA 1785-B6 (the Ridge Ruin "magician," exceptional in other ways also)—40 by 40 mm., index 100 mm.; a Sinagua skull from Arizona I:16:1 near Padre Canyon—38 by 38 mm., index 100 mm.; Starkweather No. 55 (pithouse level)—39 by 41 mm., index 95.1 mm.; the Starkweather pueblo skulls—37-40 by 37-40, index 85-108 mm.; Swarts Ruin, the orbit heights up to 41 mm. (mean 34.6) but the index only to 92 mm.; the Durango Basketmakers, orbit heights 34-38 mm. and left orbit index up to 95.0 mm.; Alkali Ridge N/917-38 by 39 mm., index 97.4 mm.; and apparently three of the five male skulls from Tse-Ts'a in Canyon de Chelly National Monument (Reed, 1966a; I should have rechecked these orbit measurements an extra time).

Turning now to the Pueblo Pardo adult females, the largely identical dimensions of the two are close to Anasazi norms, but the proportions are again very hypsiconch—within Pecos and Paako ranges, but well above the averages. Their index of 94.6 mm. is exceeded by the Mogollon Village and Peñasco Bend skulls (each 36 by 37 mm. for an index of 97.2 mm.); by a portion of the Starkweather Pueblo range (35.6-38.7 by 33.6-48.2 mm., the index from 89 to 106 mm.! I cannot help being incredulous or dubious about a dacryal breadth of less than 34 cm., which is below the entire Pecos range or any other Southwestern material known to me), but none at Swarts Ruin; by another unusual Sinagua(?) cranium from Winona in the Flagstaff vicinity, NA 2131-B1 (38 by 37 mm., index 102.5 mm.); by Burial #1 at LA:3333, a Highway Salvage site in the Galisteo Basin (38-38 by 40-37 mm., index 97.4 mm.), and a few at Paako and Pecos; and finally, also by two Alkali Ridge females in southeastern Utah (indices of 94.7, 97.25 mm.), Bc 59-34 from Chaco Canyon (36 by 38 mm., index 94.7 mm.), and Burial 6 from Site 34, Mesa Verde National Park (34.5 by 35.5 mm., index 95.7 mm.).

As keeps happening with deviant traits which at first glance I think may have regional significance within the Southwest (such as gonial flare or deeply concave suborbital canine fossae), the occurrences of extremely hypsiconch orbits in San Juan Anasazi material, as indicated above, as well as in southern Pueblo series of Mogollon cultural background (such as Starkweather Ruin, in the Tularosa River drainage, and Swarts Pueblo, on the Mimbres) and Sinagua crania, make is difficult to establish local differentiation and special affiliations on the basis of this feature.

There is, however, one apparently localized variety with which the Pueblo Pardo material may possibly have some degree of relationshipo. This is the San Simon type of southern Arizona, characterized by a very low and narrow frontal—postorbital construction and sloping forehead—and by a median crest of the frontal with considerable sagittal elevation of the parietals. Most of the few published crania from southeastern Arizona (Brues, 1964b) are of this type: the two Cave Creek specimens (Peñasco Phase, surely before A.D. 500) but not the one Peñasco Phase skeleton from the San Simon (N/3655, from Chiricahua 3:25); apparently not, but not definitely excluded by available information, the Sulphur Springs (Cochise) individual from Sonora F:10:17 (statement by E.A. Hooton, p. 65, in Sayles and Antevs, 1941); and two of the three crania from the Dos Cabezas phase (which must fall around or before A.D. 500) at the San Simon Village (Brues, 1946b).

Very little trace of this element can be seen in later phases there, running up to about the 11th century (Sayles and Antevs, 1946). Brues (1964b, p. 548) compared the low-vaulted San Simon material with modern Yaqui. Burial 14 at Ventana Cave in the Paguería, an undeformed male dismissed as a mere aberrant individual variant by Gabel (1950), corresponds very closely to the San Simon type. It and the Ventana Cave females compare well with modern Papago (ibid., p. 502).

The crania from Pueblo Pardo are, as a group, distinctly low-vaulted for the most part; with narrow and retreating foreheads—in most of them, frontal height and fullness are low, the frontal bosses undeveloped, and the faces appear large relative to the braincase. Sagittal elevation and median cresting of the frontal are noted on male #16 and female #32. Very slight sagittal elevation on #30 and 12 is not accompanied by any prolongation on to the frontal. Adult female #12 has fairly well-developed frontal height and fullness, even bosses, but again, a narrow frontal width.

Post-Cranial Skeleton

Items noted in bones of the torso, aside from age and sex criteria, include the following: (1) considerable osteoarthritic growth on the lumbar vertebrae of #9 (about 35 to 40 years old), and small exostoses on several vertebrae of #16 (age 45 to 50); (2) variations in the sacrum (see following separate paragraphs); and (3) variations in the sternum. There is a large sternal foramen in the lower portion of #12 (female) and #15 (male). In young adult males #15, 33, and 36, and in females #12 and 32, the manubrium and gladiolus are separate; in the other three males (ages 35 to 50), they are combined. In male's #16, 30, and 33, the ensiform process or xiphoid appendix is also combined (definitely not in youthful female #32; seemingly not, or uncertain because of damage, for #9, 12, 15, and 36). In #36, age just about 17 years, the segments of the gladiolus have not united yet.

None of these conditions is particularly unusual, but hitherto I have largely neglected the sternum in working up even smaller collections of Southwestern material, usually in much poorer condition, with a complete sternum a rare find. No special features of ribs, clavicle, or scapula were observed.

A six-segment sacrum is accompanied by four lumbar vertebrae in #30 (male, 35 to 40 years old), and there are only four segments to the sacrum in #12 (young adult female) and #36 (male, 17 years old), with a sixth lumbar vertebra in at least #12. If #36 had a sixth lumbar vertebra, as ought to have been the case, it is among the several (including a few other vertebrae) missing bones. Skeletons #15, 16, 32, and 33, and probably #9 (badly damaged), had normal five-segment sacra (with the top segment not yet fully united in #15, 32, and 33, which is normal for an age in the early 20's).

The six-segment sacrum, formed by the incorporation of the fifth lumbar vertebra, is not a rare phenomenon; rather, it has a fairly high incidence in the Southwest. The occurrence of a sixth lumbar vertebra with a four-segment sacrum is apparently less common and is not mentioned at all for Pecos, but I have encountered quite a few other instances in Southwestern material (Reed, 1967).

Limb bones are, for the most part, of only moderate size and muscularity–the humeri and bones of the leg are considered large and strong only in middle-aged male #9, as are the arms of young male #15, but not the legs. Humeral torsion above the normal average condition is noted in males #15 and 30 (cf. Krahl, 1947): notably, curved "bent" ulnae in male #30, in youthful males in #15, 33, and 36, and in female #12; it is excessively so only in #15. The humeri of #15 are bent as well as twisted.

Septal aperture of the humerus (perforation of the olecranon fossa, the socket which receives the tip of the head, or the olecranon process, of the ulna) occurs in the right arm of #16 (male, very likely post-mortem damage), the left only of #32 (female, does not look accidental), and on both sides for #33 (youthful male). This is a reasonably normal incidence.

Pilastering of the femur is generally slight or absent in this group, and definitely marked only in middle-aged males #9 and 16. Retroversion of the tibial head is negligible or slight, with very slight development of squatting facets on three of the males (#15, 16, and 30) and on the right tibia only of #32 (female). The shaft of the tibia is rather slender and very flat only in young male #33, whose tibiae are rather curved, and whose fibulae, especially the right, are distinctly bent.

The peculiarities–the bowing and curving of several bones in various individuals–presumably reflect a nutritional deficiency. None of them seems to represent a healed break or other definite injury.

Stature, as indicated in Table 49 (along with long-bone dimensions), is within the normal Pueblo ranges; both females are virtually right at the average. A generally mesomorphic build is likely to have been characteristic, in spite of the somewhat low muscularity of the long bones and of the nuchal area of the occiput. The rather large clavicles, with the claviculo-humeral index running around 50 mm., imply a square-shouldered, sturdy build.

Pathology

In addition to those special features and anomalies already mentioned–the divided malars of #5, tooth wear and pre-mortem tooth loss, variations in sternum and sacrum, the notably curved bones of the arm and, in #33, the leg (possibly ascribable to dietary factors?)–the skull of #16 manifests several peculiarities: (1) conspicuous lumps can be seen on the inner surface of the mandible alongside the second premolar and first molar on each side (not a typical mandibular torus, and not accompanied by a palatine torus or any other unusual development on the upper jaw; cf. Krahl, 1949b), and on the first molars the severe tooth wear slopes downward posteriorly, meeting oppositely beveled surfaces on the upper first molars; (2) a cut, scraped, or gouged, slightly depressed area, 25 by 11 mm., appears on the left parietal, with an opening that normally does not belong there (the parietal foramina that occur frequently, but by no means always, on either side of the sagittal suture are not present), and presumably represents a wound, no doubt pre-mortem but just barely so. Other instances of cranial damage appear to be due to post-mortem accidents.

Summary

The small collection of human skeletal material from Pueblo Pardo, representing a Pueblo population of the 14th or early 15th to early 17th centuries, presents certain minor deviations from the normal Anasazi, Pueblo, Southwest Plateau, or Ashiwid type, and also manifests heterogeneity in some respects–notably in the cultural factor of artificial cranial deformation (cradleboard flattening). Nevertheless, there is general correspondence, morphologically and metrically, to the Southwest Plateau type, and close resemblance in many items to Pecos means and to San Juan Anasazi material.

Possibly the low vaults and narrow and retreating foreheads are sufficient for tentative alignment with the San Simon variety of southern Arizona (Brues, 1946b; Burial 14 at Ventana Cave), but the median cresting of the frontal and the sagittal elevation of the parietals that also characterize the San Simon group occur in only two of the skulls from Pueblo Pardo.

Stature, body build, and muscularity are, so far as determinable, typical for Pueblo Indians.

Features of interest include the notably hypsiconch orbits; the occurrence of an *os japonicum* (the malars horizontally divided by an unusual suture); a six-segment sacrum and two instances of a sixth lumbar vertebra with four-segment sacrum; abnormally curved bones of the forearm–in one individual the humeri, and in another the tibiae and fibulae; and one probable head wound. Otherwise, pathology seems lower than usual in Southwestern material, with less arthritic growth on the vertebrae or other bones of the middle-aged adults than is often the case.

General Discussions

Age at Death–Life Expectancy

In my report on burials from the Galisteo Basin sites (Reed, Ms. a), I discuss life expectancy and life span at some length, bringing together everything I know, and neglecting only a few papers in which determination of age is based on obliteration of cranial sutures (e.g., Senyürek, 1947), a flaw probably also characterizing some of the comparative material I did bring in. However, right after I finished the Galisteo manuscript, the following item, a "statistical thought for this week," was published in *The New Yorker* (September 17, 1966): "During the first half of every American's life he is more likely to die in an auto accident than from any other cause, . . ."

The technically proper way of stating life expectancy, although not quite as confusing as the foregoing, is somewhat misleading. In the prehistoric Southwest, life expectancy at birth was around 15 years, but only rarely did anyone die near that age. This figure actually represents a combination of a very high infant mortality rate, often approaching 50 percent, with most deaths occurring later than age 3 or so, and falling between 25 and 40.

Almost 50 percent infant mortality (through age 4, with an unjustifiable assumption, for purposes of discussion, that most of the cremations listed as "infant" or "small child" fall in this bracket), as in the Mound 7 collection, is fairly normal. Only comparatively few deaths between about 5 or 6 years of age and age 18 or 20 also seems typical in Southwestern material. And so is a spread through the third and fourth decades–comparatively few under 25 and very few beyond about 50 years.

The small collection from Pueblo Pardo shows a closely similar distribution, and so do the slightly larger series from two ruins in the Galisteo Basin. In the case of Pecos, the figures given by Hooton (1930) are misleading, based on the material brought in for study, rather than on the total of burials found, from which a more normal picture emerges (Kidder, 1958, pp. 283–284).

More specifically, of the 361 unburned inhumations collected in excavating Mound 7 at Las Humanas, the age was assessed on 319 specimens; there were 42 adults of uncertain age, most of them listed as mature rather than youthful. Sixty-four, or almost 18 percent of the total, died by age 1 (40 at or before birth, and 24 during the first year of life) and another 26 percent between 1 and 4 years old.

Of the remaining 56 percent, another 26 individuals, or 7 percent, died at 4 to 7 years old. But then, there are only 20 (5½ percent) from 8 to 12 years old, 9 (2.5 percent) between 12 and 18 years, and 10 (2.8 percent) at 18 to 21. Of the 139 individuals (38.5 percent of the total) who attained maturity, comparatively few died in their early and middle twenties. There are 23 deaths—6.4 percent of the total series, 21.5 percent of the adults (those over 18) on which age was evaluated—recognized at between 22 and 27. A few of the adults of undetermined age undoubtedly belong in the 18 to 21 and 22 to 27 categories.

The second period of concentration of decease is from about age 27 (complete maturity—union of sternal epiphyses with the clavicle, and Stage V of development of the pubic symphysis) to between 38 and 42 (Stage VIII). Sixty-four individuals (or 20 percent of the 319 individuals of specified age, 60 percent of the 107 of these which are over 17 years old; 17.5 percent of the total, 46 percent of the total of 139 over 21 years old)—and presumably most of the adults of unspecified age also fall in this bracket—are mature adults up to about 42, probably mostly in their thirties. Finally, there are, according to my determinations, only 10 over 42 years old, of which 3 or 4 are age 50 or over. In reviewing about a hundred skeletons (75 of thlem adult) from the first two seasons, Dr. Christy Turner placed 8 in the 56–75 bracket, the only serious discrepancy in our estimates on age.

I had placed #161, 175, and 265 at ages 35-42, #237 and 281 as between 27 and 38, #202 and 329 as 42 to 50 or over, and #142 as "adult of indeterminate age." Here I am inclined against simply accepting Turner's findings, even though this attitude probably derives largely from a preconceived belief.

Of the 149 individuals over 18 years of age, 54 are males, 81 are females, and 14 uncertain (4 thought to be male, 5 probably female). In the age bracket from 19 to 27, there is a disproportionate predominance of females—25 or 26 (if #193 is female after all) to only 8 (or possibly only 7) males, presumably ascribable to problems of childbirth.

Cranial Deformation

The skulls from these ruins in the Gran Quivira district are very different, as a group, from those known in the Pueblo area generally as regards deformation. In fact, the effect is decidedly un-Southwestern.

Twelve of 18 crania from Pueblo Pardo are undeformed; on 4 of the other skulls, the artificially produced flattening is vertical or approximately so, and moderate to very slight; 2 are slightly flattened obliquely. In the 1956 series from the campo santo at Las Humanas, 8 of 23 crania are underformed; 5 have definite occipital deformation, vertical to intermediate (one pronounced, the others moderate); there are 9 with slight and limited flattening at an intermediate angle, irregular and ill-defined; and, finally, one which I originally listed as "genuine" lambdoid and moderately pronounced, but which actually is not of the true San Juan type. Of the three skeletons collected in 1967 in the campo santo, the male is definitely undeformed, while the two females both show moderate occipital deformation at angle close to vertical. Two of the 1968 crania are undeformed, but the other provides the only instance of extremely pronounced and highly asymmetrical vertical occipital deformation. In summary, then, there are a total of 11 undeformed skulls from the campo santo, 8 skulls with more or less vertical occipital deformation, and 10 nondescript or variable deformation.

In the large collection from the Mound 7 excavations, only 60 (29.5 percent) of 204 crania are deformed at all, most of them at an intermediate angle and only slightly. Only a few are listed as pronounced, one of them vertical, none of them lambdoidal. Several others are vertical, slight or moderate; 12 are lambdoid in angle but slight or moderate. The "intermediate" specimens range from approaching lambdoidal to almost vertical—65° or 70° to between 80° and 85° in the inclination to the Frankfort horizontal (eye-ear plane). Many of these are only very slightly flattened, and irregularly, not always really flat and with no clearly definable area of deformation. On the other hand, quite a number of those classified as undeformed may actually have undergone some amount of unnatural flattening not clearly recognizable.

The only good example of really powerful artificial cranial deformation on record so far (1967) from this area is a child, 7½ to 9 years old, from Pueblo Blanco (LA:51), about 15 miles northeast of Gran Quivira, a large ruin identified as Tabirá (Stubbs, 1959). The skeleton, collected by Stubbs in excavations there during June 1959 (catalogued as Museum of New Mexico specimen 17083/18), is distinguished by very pronounced occipital deformation of the true vertical type, producing a cranial index of 100 mm. (cranial length 149 mm., maximum breadth 149; the basion-bregma height is 131 mm.).

The intermediate angle of artificial flattening is not too unusual in the Southwest, occurring in the Rio Grande Valley, apparently typical in southern Utah (Reed, 1963a), and occasionally appearing elsewhere among normally lambdoidally deformed material (e.g., Stewart, 1958) or, quite often, in collections with essentially vertical occipital deformation, in part slightly less than 90°, but quite definite and unmistakable.

But the situation here is quite different. Rarely have I had serious difficulty elsewhere in deciding whether a reasonably well-preserved skull, or even a fragmentary one, is deformed or not. In fact, upon concluding the study of the collection from the first season of excavations at Mound 7 (Burials #1–106, including 75 unburned inhumations) in 1965, I went so far as to write the following passage:

> The observable skulls seem to be, with few exceptions, undeformed or else distorted irregularly. There seems to be no definite instance of typical flattening of the occipital or lambdoid regions of the back of the head, accidental or intentional, by the use of a hard cradleboard to which the baby was rigidly lashed. As with material from Pueblo Pardo, however, there are, aside from obviously postmortem distortion, several crania which are quite unnaturally and asymmetrically shaped. In others a generalized lambdoid flattening, covering a small area, not asymmetric, and not in a sharply flat plane, may be of natural origin.

> At first I listed a few children (Burials #2, 15, and 25) as manifesting definite though not pronounced cranial deformation, at an intermediate angle, not asymmetrical. On reconsideration, I believe these also should not be listed as true artificial occipital deformation, although the flattening could well be from a cradling practice rather than entirely natural. For most observable specimens I put down in my notes such statements as "cf. def. slight if any, lambdoid area somewhat flattened" or "occipital flattening—not flat." I have no reasonable explanation for the radically distorted skulls in which the deformation can scarcely be post-mortem. The foregoing applies to the Pueblo Pardo material also, with twelve crania definitely undeformed and six vaguely, uncertainly, and irregularly flattened.

In the 1966 and 1967 material, however, enough recognizably deformed skulls turned up, with the majority clearly undeformed, that I had to radically modify this view. Reviewing my notes and compilations in draft, I find that in reaching the figures given in this report, I considered #2, 15, and 25 as deformed, and three others from 1965 (#14, 17, and 18, male adults) as very slightly so. Similar perplexity and uncertainty is evinced in my statements on the crania from the campo santo and Pueblo Pardo, which I have not changed much (except for some deletion of repeated comparative data) from the original versions written in the form of separate reports.

A predominance of undeformed skulls also characterizes Hawikuh in the Zuñi country in the same general period, at least in late Pueblo IV times (probably within historic times, in the 16th and 17th centuries; cf. Seltzer, 1944, p. 5). The only other major occurrence in New Mexico of cremation of the dead is also at Hawikuh, specifically in the 16th century (Reed, 1955, p. 188).

In the upper Rio Grande area, however, occipital deformation is characteristic in Pueblo IV. At Pecos, there were only 6.5 percent undeformed, or 40 out of 615 crania (Hooton, 1930, p. 33). At Paako, only one of 25 skulls reported on is undeformed (S.L. Rogers, 1954, p. 15). At Pindi, all of the 13 observable crania "show cradleboard deformation to some extent, in the lambdoid or occipital region, mostly the former" (Stubbs and Stallings, 1953, p. 145; see further discussion below). At Te'ewi, occipital deformation predominates (Reed, 1953, p. 106), as well as in Rio Grande Pueblo IV material generally. In the Galisteo Basin, lying between Paako and Pecos, the great majority of the skulls that have been collected and studied are deformed (Reed, Ms. a.).

Lambdoid cranial deformation is a trait of restricted distribution in time and space, distinctively characteristic of the Anasazi of the northern Southwest, from the upper Rio Grande area to beyond the Colorado River, and from sometime in Pueblo I (A.D. 750-900) to the abandonment of many districts about A.D. 1300 and into the historic period in the Hopi country.

In the upper San Juan, incidentally, marked asymmetry is characteristic of the Chaco-Puerco-Mesa Verde groups, at least as far west as Canyon de Chelly. The only Kayenta material I have examined (a small series from Inscription House) is characterized by very pronounced lambdoid deformation with not one instance of asymmetrical compression.

Deformation at an oblique angle is also common at Casas Grandes, Chihuahua, evidently intermediate rather than true lambdoid—"oblique occipital" (T.W. McKern, personal communication, 1964); lambdoid cranial deformation also occurs, apparently at a rather late period, in southern Mexico (Stewart, 1947).

Vertical or almost vertical occipital deformation is much more widespread in the Southwest: in Mogollon from the earliest known ceramic horizons (Peñasco and Pine Lawn phases, before A.D. 500) on into Pueblo IV; in Sinagua from an unknown time of introduction on, and in "classic Hohokam"; in the Puerco River area in the White Mound phase (Anasazi, in the 700's); occasionally in other San Juan Anasazi complexes, particularly Mesa Verde in Pueblo III; in the Zuñi country in Pueblo IV—preponderant among deformed skulls from Hawikuh and Heshotauthla (C.E. Snow, personal communication, 1962); and in the Rio Grande, especially in later horizons.

The lambdoid style appears to have been the more common style in the upper Rio Gande prior to about A.D. 1300, but more or less vertical artificial flattening also occurs. Early brown ware pithouse sites in the Albuquerque-Jemez area have yielded a few occipitally deformed crania—for example, LA:3290, an essentially Basketmaker III site with Red Mesa Black-on-white, hence dating around A.D. 900 (S. Peckham, 1957; for the skeletal material, Reed, 1957). Another site of the same general period south of Albuquerque in the Isleta vicinity, LA:3122 (pithouses with Kana'a and "Red Mesa-like" pottery), yields crania with both lambdoid and with vertical deformation (Skinner, 1965).

One of the few Pueblo II occurrences of the vertical type is at a small highway salvage site, LA:3638, in the Rio Puerco drainage southeast of Laguna (Reed, Ms. b). A southerly instance of intermediate lambdoid, in late Pueblo II or early Pueblo III, is from LA:2567, on the Rio Puerco west of Belen (Fenenga, pp. 233-241, and Reed, pp. 393-394, in Wendorf, 1956). Both types are present at LA:835, north of Santa Fe near Cuyamungue, a small ruin of the 11th and 12th centuries, yielding two deformed skulls, one of each kind, and an undeformed small infant (Stubbs, 1954, p. 45).

Of the dozen crania recorded from Pindi, a Black-on-white Pueblo III site close to Santa Fe, occupied into the beginning of Glaze A times, or to about A.D. 1350, half are lambdoidally deformed and half vertically—or intermediate but distinctly closer to vertical than to the 50°-70° angle of artificial lambdoid flattening (Howells, in Stubbs and Stallings, 1953, ills.; and Laboratory of Anthropology collection, including an additional skeleton found long after the excavations—a male adult with moderate lambdoid cranial deformation, which I studied in 1956.

The statement which I have repeated (Reed, 1949)—that deformation at Pecos is entirely or almost entirely of the vertical type—is incorrect. Examination of data and illustrations in the Hooton's report (1930) clearly suggests that lambdoid cranial deformation was common in the black-on-white period, was apparently present in Glaze A times, and also occurred in later Glaze horizons. Most of the specimens that Hooton labeled "slight" or (especially) "very slight" occipital deformation evidently are lambdoidally flattened. There are also numerous vertically deformed skulls, in black-on-white and Glaze A times (before A.D. 1350), as well as later.

Both types appear, with lambdoid predominating, at Paako (S.L. Rogers, 1954). On 15 of the 25 specimens the plane of deformation is at an angle between 50° and 70°, moderate in degree but classifiable as lambdoid. There are also seven that are intermediate in type (between 70° and 80°); only two show true vertical occipital deformation (85°-90°), and one is undeformed. The majority of these come from the 14th century occupation at Paako (black-on-white and Glaze I pottery), including all of those deformed lambdoidally (and two vertically, four intermediate). Four of the burials reported on (#6, 8, 12, and 16) come from the Glaze V-VI component of the 17th century; one is undeformed, one is high intermediate (76°), and two are vertical. None are lambdoid.

The few crania from the Galisteo pithouse village, LA: 3333, are all deformed lambdoidally; no other "pre-13000," or pre-glaze, material is available from the Galisteo Basin. This little site, with Santa Fe Black-on-white and no glaze-paint ware, presumably falls in the early or middle 13th century.

The burials from Pueblo Largo in the Galisteo Basin all presumably come from the end of the 13th century and into the 14th (black-on-white and Glaze A associations). Cranial deformation is lambdoid in 6, intermediate in 2, and vertical in 10, with no undeformed skulls.

In those from Las Madres (LA:25), of approximately the same period, vertical occipital deformation is characteristic, being in most cases very pronounced (nine examples, plus four only moderately); two crania are undeformed, and the lambdoid style does not occur.

It would appear that vertical occipital cranial deformation appeared in the Rio Grande well before 1300, until about which time the lambdoid type predominated, and in the course of the 14th century vertical occipital deformation became characteristic in this area, during the same period in which glaze-decorated pottery was introduced.

As emphasized by this review, artificial cranial deformation is typical of the Pueblo Southwest. After somewhere around A.D. 750 in the north, and far earlier among the Mogollon to the south, a rigid, flat, hard cradleboard was used, to which the baby evidently was firmly strapped. In the Anasazi, an additional feature, such as a pad under the neck or a wedge-shaped wooden pillow, or both together, was used to produce a sharply defined flattening at an oblique angle.

Absence of definite cranial deformation, aside from occasional individuals, is apparently complete only at one site in the Southwest later than White Mound times—the Joyce Well ruin in Hidalgo County (southwesternmost New Mexico, probably of the 14th century), where a series of nine observable skulls were uncovered (Reed, Ms. e). The predominance at Hawikuh, still later in Pueblo IV times, is a matter of approximately two-thirds undeformed. Both types of deformation appear in a group of crania from the old church at Zuñi Pueblo, which must be of the 18th or 19th century—four lambdoid, five vertical, nine at an intermediate angle near the vertical, and several apparently undeformed (Reed, 1972).

The situation in the Gran Quivira vicinity, at Las Humanas and Pueblo Pardo, is quite different. Occipital conditions here are generally un-Southwestern and reminiscent instead of the Plains, where cranial deformation is generally negligible—usually referred to as "possible slight cradleboard flattening" or some similar phrase and not given much weight in discussion—except for mound-building Mississippian groups at the eastern side, with occasional extension into the Plains, for example, the historic Kansa (Stewart, 1959).

Evidently cradles used in the Plains were softer or more flexible, or else—probably more important—the infant was not so rigidly lashed on as in the Southwest. And obviously something like this must also have been the case at Las Humanas and Pueblo Pardo, in contrast to the Rio Grande Valley. Possibly the weak development of the trait signifies that it was gradually being dropped, perhaps under outside influence, which seems more probable than any hypothesis under which the custom would have been introduced only recently an in attenuated form.

Pathology, Anomalies, Peculiarities

In a lengthy report on skeletal material from sites in the Galisteo Basin for Bertha Dutton, I discussed, with comparative data and comments—in other words, all I know about each topic—several anomalous, pathological, or otherwise unusual phenomena: divided malar (*os japonicum*), assimilated first cervical (atlanto-occipital fusion), supernumerary incisors (see Snyder, 1960), the supracondyloid process of the humerus, septal aperture of the humerus (supratrochlear perforation of the olecranon fossa), fused metacarpals and metatarsals, third trochanters, and "squatting facets," as well as build and stature, life expectancy, and artificial cranial deformation.

The last three subjects have been treated again herein (stature in the "Mound 7" section instead of separately); there is further discussion in that section of spinal variations and septal aperture of the humerus and third trochanters, as well as mention of a few supernumerary teeth and lingual ridges. Also discussed there are several other anomalous or pathological features, and a notable pathological skeleton. In the "pithouse" section a pathological hipjoint is discussed (by Thomas W. Mathews), and a comparable occurrence is cited.

In a separate brief paper (Reed, 1967) I have summarized certain variations of the spine, particularly the lumbo-sacral area, in Southwestern archeological material. In a report of skeletons from Navajo National Monument (Reed, Ms. h), I have devoted special attention to cranial sutures (except for pterion arrangements), intersutural (Wormian) bones, and *os inca* (divided occipital).

Here, I take up similarly additional items: persistence of the metopic suture, epipteric bones and other variations of the pterion area, missing cranial sutures, precondylar tubercles, perforated gladiolus (sternal foramen), cervical ribs and bifid ribs and bicipital ribs, fused bones of the forearm, and peculiar metatarsals.

Special topics that will receive study at Arizona State University, in addition to dental traits, include dehiscences of the tympanic plate (e.g., Mound 7 specimens #317, 404, and FS-2812) and incidence of the pharyngeal fossa, two significant items that I have not attempted to observe regularly; osteoporosis (spongy hyperostosis), which I do not feel qualified to diagnose; and instances of palatine and mandibular tori (if there are any, aside from Q/4436 and Burial #341, I missed them; most of the collection, however, definitely lack such hyperostoses, except for male #16 from Pueblo Pardo).

Metopism

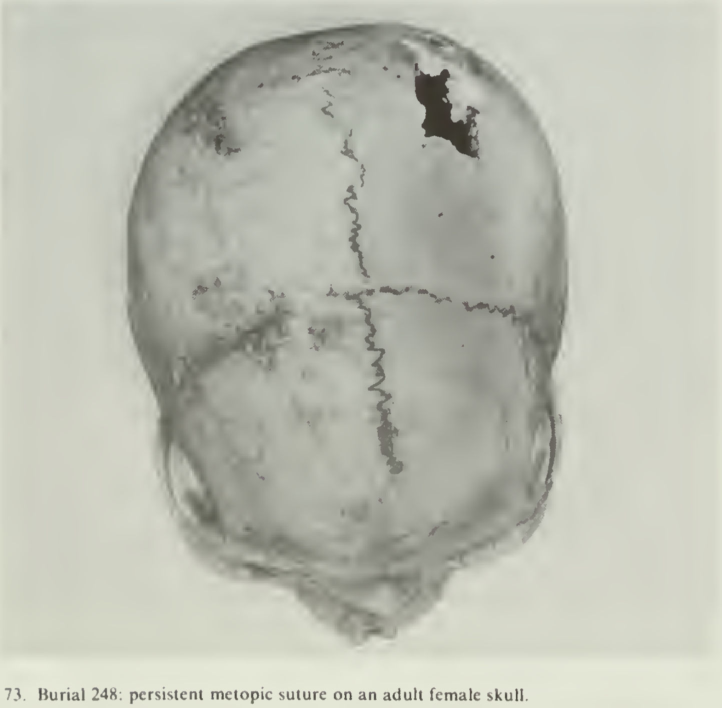
Persistence of the metopic suture into maturity, presumably with obliteration only along with the other major cranial sutures, is one of the more uncommon anatomical variations (Sullivan, 1922). The first example that I have seen, in handling several hundred Southwestern crania, is #248 of this collection (fig. 73). There was at least one case at Pecos (Hooton, 1930, Plate VI-19), and one turned up in the skeletal material encountered during the 1967 archeological work by Mrs. Jean Pinkley of the National Park Service in the mission church at Pecos—a skull found against the north wall of the church and dating from the 18th or 19th century, hence very possibly not pure Indian.

There are five metopic sutures, at least 2 of them small children, among 208 skulls from Point of Pines (K.A. Bennett, 1967b); another, a mature adult female (B112) from Grasshopper Ruin, is at the University of Arizona (Christy Turner II and Kenneth Bennett, personal communications). Finally, a partial cranium (temporarily designated "R 1099") in a small collection of miscellaneous human bones coming from an undetermined locality in Frijoles Canyon, Bandelier National Monument, combines metopism with premature disappearance of half of the coronal suture (see below).

The high frequency that has been reported for Mesa Verde (K.A. Bennett, 1975) may be misleading for the uninformed, since this includes "traces" of the suture—in other words, evidently a fine squiggly line between nasion and glabella—in addition to retention clear to bregma. There is at least one case of "genuine" or full metopism (K.A. Bennett, personal communication). Wade and Armelagos (1966) mentioned two instances of a "slight trace of a metopic suture in the bregmatic region" from site 822 in the small Mesa Verde collection.

In regard to the collection from Casas Grandes, Chihuahua (excavations by C.C. Di Peso of the Amerind Foundation), "Of the 27 males and 24 adult females examined, there was only one case of a true metopic suture. A faint supranasal suture was present in 25 of the males and 16 of the females" (R.A. Benfer, personal communication, 1967).

The "trace" of supranasal suture is something I have seen quite often on Southwestern crania, but not realized I should have recorded. In fact, I now discover that the statement appearing on page 128 in my Tse-ta'a report (in Steen, 1966) originally included "Traces of metopic suture between the brow ridges"; evidently I struck it out of later drafts, presumably considering it not important enough to mention after all. Among 42 adult crania in the Las Humanas collection rechecked for this trait, 6, or 14 percent, had the fine squiggle, like a worried frown, which I take to be what is meant by "traces" of the metopic suture. More distinct persistence of the supranasal portion of the suture, from nasion to glabella, is at least sometimes referred to as incomplete metopism or presence of a supranasal suture.


73. Burial 248: persistent metopic suture on an adult female skull.

Sullivan (1922, pp. 231-235) gave extensive listings of occurrences of metopism. In the collection of almost 2,500 skulls from the Americas that he examined at the American Museum of Natural History, Sullivan found very few North American instances (concentrated in the Northwest Coast region—none among 217 crania from the Southwest), but very high frequencies in material from Peru and, particularly, Bolivia. Figures given for American Indians in general have ranged from 1.1 percent (Russell, 1900, cited in Sullivan, 1922) to 2.1 percent (Le Double, 1903, cited in ibid.).

Additional information on this has been kindly supplied by Christy Turner II of Arizona State University, who cited a couple of references I have not examined: "L. Carr (USGS, Wheeler, 1879:283) found the suture in 2 percent of Santa Barbara crania (cited by Allen, H., 1896, Crania from the Mounds of the St. John's R., Florida, Jour. Acad. Nat. Sciences of Phil., N.S., Vol. 10, No. 4). Allen found 3/416 North American Indian crania to have metopic sutures" (Turner, personal communication, 1967).

Similar or lower frequencies have been reported for African Negroes and native Australians, and only slightly higher for Malays; much higher frequencies are listed for Melanesians (3.4 percent), Asiatic Mongoloids (5 percent), and above all Europeans—ranging mostly around 8 or 9 percent, in some groups 11 to 12 percent (Le Double, 1903, and Martin, 1914, cited in Sullivan, 1922). In the Canary Islands "the metopic suture occurs in Tenerife crania with a frequency equalled only in European . . . 12 percent of males" (Hooton, 1925, p. 131).

A study of a collection of crania of the 17th through the 19th centuries from Greifenberg, in southern Austria, reported:

> Metopism is found most frequently in Europeans . . . in 12.7 per cent of males and 19.6 per cent of females [in the Carinthian material being reported] the metopic suture was complete. It was incomplete [i.e., supranasal suture, nasion to glabella only] in 9.5 per cent of the males and in 7.2 per cent of the females. These figures agree with the percentages given for other central European groups (Shapiro, 1929, p. 55).

In three medieval (at least largely) series from Norway totaling over 1,700 skulls, the percentages of metopism run 10 to 12.8 percent (Torgersen, 1951, p. 194). Interestingly enough, however, the Lapps manifest far less common occurrence, 1.9 to 3 or 4 percent (ibid.).

A very high incidence in certain Mongoloid series has been reported, 11.5 percent in one and 13.7 percent in another (Ju-Kang Woo, 1949—66 Chinese and Mongolian skulls in the National Museum), 13.7 percent in another (a modern Chinese series—T.L. Woo, 1941, cited in ibid.), and 7.8 percent in Japanese (Schultz, 1929, cited in Torgersen, 1951). In a series of 18 male crania from Easter Island, 2 (11 percent) have complete metopism, and 7 (39 percent) show a definite supranasal suture (Murrill, 1965).

Returning to North America, the only occurrences listed by Sullivan outside the Northwest Coast area (including one of a series of 8 Athapaskan skulls from Alaska, plus a few Salish as far south as Washington and one from Oregon) are: one of 13 Eskimo from St. Lawrence Island (none in other Eskimo series totaling 184 specimens); 4 among 54 crania from a locality in Mexico named San Simon, and one from the vicinity of Mexico City (none in other Mexican series totaling 259); and one from May's Lick in Kentucky. There are also numerous collections from the Northwest Coast lacking any examples in Sullivan's 1922 compilation.

A series of 168 skulls from Illinois examined by J.K. Woo (1949) yielded not a single instance of metopism. In most other published material from the eastern, southern, and midwestern parts of the country, there seems to be no reference to metopism. However, the great collection from the Indian Knoll shell-mound, Kentucky, included 4 examples of complete persistence of the suture —one male, constituting 0.4 percent of the 258 observable male specimens, and 3 females (or 1.6 percent—whereas "traces" are recorded for 75.7 percent of the males and 42.8 percent of the females.

For the Plains area the one major production specifies lack of metopic sutures in series totaling 197 male crania (Bass, 1964, p. 99). For the Southwest (except for the instances mentioned at the beginning of this section), the Great Basin, and California, the publications I have checked indicate the absence of metopism either by lack of mention, or, in some cases, by specific negative statement.

The biological significance of unobliterated retention of the metopic suture apparently has not been clearly established. The not unreasonable notion that artificial fronto-occipital deformation might be a factor occurred to L.R. Sullivan, but he pointed out that this could not be the explanation: "It seems more probable that metopism is a local characteristic, for some cause or causes arising in a given group and transmitted by heredity. Its frequency is determined largely by its dominance and length of time since its appearance in the group" (Sullivan, 1922, p. 235).

Ju-Kang Woo's paper, which is concerned with study of the degree of curvature of the frontal bone, concludes that "skulls with complete metopism have greater frontal curvature than those without" and also that "American Whites have the greatest frontal curvature . . . and the American Indians, the smallest" (Woo, 1949, p. 225).

Torgersen, working largely on living material, found an uncertain or partial correlation of metopism with harelip and cleft palate, but considered metopism an expression of a general trend in human evolution and concluded that it was the result of a dominant gene of sporadic occurrence, correlating with the supposed general process of brachycephalization (cf. Weidenreich, 1945). According to Torgersen (1951, p. 209), "Apparently the persistence of the mediofrontal suture depends on a dominant gene, and its obliteration on the homozygous recessive normal allele. Torgersen's words sound rather like a more precise re-statement of Sullivan's general view. And perhaps Woo's point, which seems to make very good sense, could also tie in with a possible correlation with the alleged general trend toward increasing brachycephalization. However, these general explanations, it seems to me, are less readily usable to explain sporadic occurrence, such as about one in 100. Yet I see no satisfactory functional theory either.

Another possibility is faintly suggested by Las Humanas (Mound 7) specimen #248. This individual, a female probably around 27 years old and of normal Southwest Plateau physical type and average size, manifests the following peculiarities, in addition to complete metopism: an epipteric bone on the right side, and a large number and partially unusual placement of Wormian bones—three in the right half of the lambdoid suture and four in the left (not abnormal), and a large one below right asterion and two forward of left asterion (quite uncommon); and an excessive amount of pinholing (which I suppose would be considered a form of osteoporosis—far more tiny openings than would be normal even in much younger specimens) concentrated particularly in the upper portions of the humeri, especially the right, and the right ulna and radius, and also conspicuous on other long bones and the scapulae, pelvis, and ribs. I cannot help wondering if these phenomena may represent a nutritional deficiency or glandular malfunction of some sort in connection with bone growth, even though the bones are sound and strong—in fact, one of the best preserved skeletons in the collection. The same abundance of "pores" also is true of the cranium with metopism from the Pecos church.

As with so many anomalies, metopism has to be regarded as an interesting and unusual phenomenon, the mechanism, etiology, and possible effects, if any, of which are not fully understood.

Arrangements of the Pterion Area

There is a variety of pterion arrangements in the human species, a spheno-parietal contact of H-form being the commonest in modern races (Ashley-Montagu, 1933; Murphy, 1956). Others are fronto-temporal contact of K-form (or inverted "H," *pterion retourne,* when the frontal-squamous contact is broad), stellate of X-shaped, and the presence of separate little epipteric bones. Fronto-temporal K-articulation preponderates in the African great apes, but it is not frequent in most human groups—from 2 percent in Europeans to 10 to 12 percent in Australian natives (among whom the sphenoparietal "H" runs about 62 percent). The incidence of epipteric bones is less than 1 percent in apes, about 13 to 22 percent in European groups, 26 percent in Melanesians, and 24 to 28 percent in Australians. In a total of 334 crania from the Canary Islands, "The pterion . . . is almost invariably of the broad H form," but there are 10 instances of the *pterion retourne* and one X-form (Hooton, 1925, p. 238). In a small series from Easter Island, there are high percentages of other forms, with predominance of the H-arrangement—of 16 male crania, there are 2 stellate on the left side, and 3 cases on each side of epipteric bones (Murrill, 1965).

In the American Southwest, the H-type is generally predominant, but the K-arrangement occurs fairly often (K.A. Bennett, 1975; Hooton, 1930, p. 96). The figures given for the great Pecos collection are: large and medium "H"—males, 70.8 percent, females, 59.3 percent; narrow "H"—males 11.5 percent, females 16.5 percent; "K"—21 of each sex, constituting 16.15 percent of the males and 23.1 percent of the females; and 3 cases of *pterion retourne*, 2 males (1.5 percent of 130 crania) and one among 91 female crania (Hooten, 1930, p. 99). In smaller series, the "H," usually fairly broad, is normal in most areas.

There are, however, several groups in which the K-form is characteristic—the Swarts Ruin in the Mimbres Valley in southwestern New Mexico, all 15 crania (Howells, 1932, p. 140); Alkali Ridge in southeastern Utah, all 8 observable cases (Brues, 1946a, pp. 318 and 323); and the Largo phase in the Gallina River country of northern New Mexico (Lange, 1940, 1956). There are other scattered or individual occurrences of the K-form, for example, one from north of Gobernador, New Mexico (Reed, 1963b).

Epipteric bones appear occasionally in the Southwest, sometimes on one side only. Frequencies at Pecos are given as 8.7 percent in males and 10.7 percent in females (Hooton, 1930, p. 99). Presumably this includes occurrences on only one side. Two instances at Paako, in a series of 25 skulls, are males (S.L. Rogers, 1954, p. 15). None are mentioned for the Swarts Ruin.

In the San Juan area, a female from Site 8 on Alkali Ridge has an epipteric bone on the right and a K-shaped left pterion (Brues, 1946a, p. 323). A female adult from Wetherill Mesa has an epipteric bone on the right and an H-form left pterion, and a child in the same series has epipteric bones on both sides (K.A. Bennett, 1975). An unusually high incidence appears in the Navajo Reservoir area, along the San Juan River on both sides of the Colorado-New Mexico state line: four cases in a series of 18 crania, or 16.6 percent (Bennett, 1966a, p. 536, and figs. 53, 54).

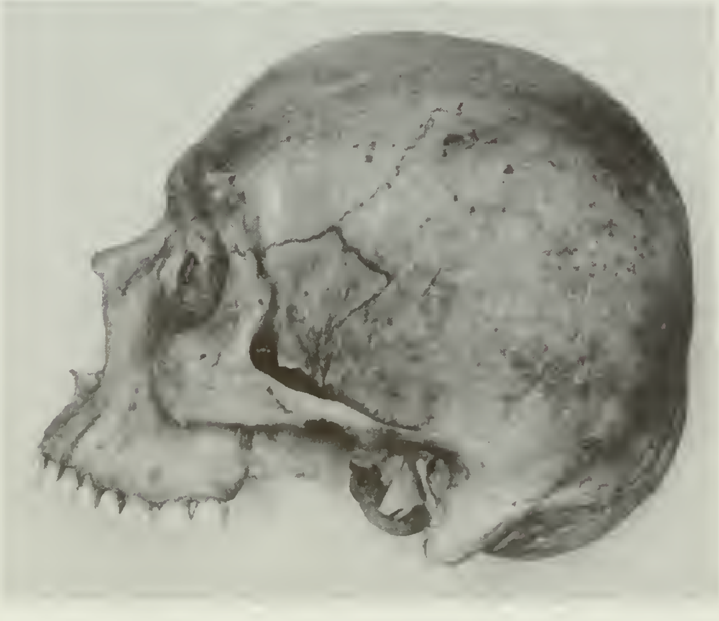
An incidence of 8.7 percent is reported for the Point of Pines population in eastern Arizona (K.A. Bennett, 1967b). In a group of a dozen skulls from the old church in Zuñi Pueblo, which I have recently examined, one designated as "W-4" is bilaterally equipped with one epipteric bone on the right side and two on the left.

In the Las Humanas (Mound 7) collection, the normal H-form is characteristic (and reappears on all the Pueblo Pardo crania), but there are several exceptions. Burial #169 has epipteric bones on the right side in #320 an X-shaped appearance is produced by small epipteric bones. The right pterion of #213 seems to be a genuine "X," but perhaps would be properly classified as a K-form. The right side in #262 is a narrow "H," as is the left, but with the addition of an epipteric bone posterior to the parietal-alisphenoid suture–a variant of Type 1 of Murphy (1956), but seeming to overlap the temporal rather than displacing sphenoid and parietal territory.

There are a couple of instances in the campo santo collection of a small epipteric bone on the right side only, but again the "H," narrow to wide, is normal.

Other Sutural Abnormalities

Other sutural abnormalities have been found. First, a strikingly unusual condition, although less conspicuous than the metopism just discussed, appears on adult male #333: the left temporal and parietal are united, and the squamous suture is completely obliterated, although other sutures in this adult cranium have not even begun to go; the temporo-occipital suture and the H-shaped pterion area are normal (fig. 74). There are two cases like this in the University of Arizona collection, and several–all but one of them children–with the sagittal suture similarly eliminated prematurely, and finally, one even stranger infant cranium in which one-half of the coronal suture is gone, the other half is normal, the left parietal is completely united to the frontal (K.A. Bennett, 1967a). Among the crania from the campo santo of San Isidro at Las Humanas, there is one with the left half of the coronal prematurely obliterated, but with faint traces remaining.



74. Burial 333: skull showing united left temporal and parietal.

In addition to the 16 cases of craniosynostosis or craniostenosis from Arizona described by K.A. Bennett (1967a), and these 2 from Las Humanas, there is one from site NA 7145 in the lower Glen Canyon area in southernmost Utah–an infant, neonate or fetal, with all sutures almost closed (K.A. Bennett, 1966b). There is also an example in the University of Utah collection from an unspecified site on Mustang Mesa–an adult skull (specimen #11685) with sagittal obliterated, and the coronal, squamous, and lambdoid sutures completely open.

A striking combination of anomalies appears on a partial cranium from, presumably, Frijoles Canyon in Bandelier National Monument. Of somewhat uncertain provenience, the specimen is temporarily designated as "R1099." Persistence of the metopic suture is accompanied by obliteration of the right half of the coronal suture. With both of these rare phenomena occurring, this cranium surely is close to unique.

The probable nature of the inheritance of this kind of abnormality was discussed in an article by Walter E. Nance and Eric Engel of the Department of Medicine of Vanderbilt University. However, as Kenneth Bennett pointed out:

> Nance and Engel make one dreadful error when they state "A particularly striking feature of this and reported cases of pyendysostosis is a dysplasia of the skull in which the cranial sutures did not close normally. This condition led to the erroneous diagnosis of hydrocephalus." Anyone familiar with the problem should know that retarded synostosis of the cranial sutures *absolutely does not* result in "a large head". They are making the common error in assuming that a suture is equivalent to an epiphysis, i.e., that a suture generates within itself an expansive force which pushes the bones apart. Expansion of the skull, of course, is due to brain growth, not bone growth. (K.A. Bennett, personal communication, 1967).

The etiology and effects of premature cranial synostosis are discussed thoroughly in a paper by Dr. Bennett (1967a).

The interesting item in this department in the Pueblo Pardo series is the horizontally divided malar, or *os japonicum*, of #5. There is one other case on record in the Southwest, from Las Madres (LA:25) in the Galisteo Basin (Reed, Ms. a).

In the Mound 7 collection, among several occurrences of lambda bones (most of which seem to be simply Wormian bones located at the middle of the lambdoid suture), none is a true divided occipital, or interparietal bone, like the tripartite one from LA:6380 near Prewitt, New Mexico (Reed, Ms. d), and several known in Arizona (see discussion in Reed, Ms. h). There are four specimens in the Mound 7 series, however, that I would classify as *os inca*, even though they do not quite match the interparietal category–that is, the occipital is not horizontally divided at the asterion level. But it appears reasonable to classify a lambda bone that is larger than typical Wormian bones, approximately symmetrical, and with a nearly horizontal inferior suture as a small Inca bone, rather than as simply another Wormian bone.

In Las Humanas cranium #150, there is a lambda bone that is large (maximum breadth 52 mm.) and essentially symmetrical, but the lower margin is not horizontal: this one is a diamond-shaped Inca bone. Adult male #508 exhibits a smaller one; #489, a child of about 7 years, has a bipartite Inca bone (rather than simply a pair of large Wormian bones on either side of lambda); and #480, about 3 years old, has a tripartite one—almost qualifying as an interparietal bone, with the occipital divided only a little above the asterion level (see fig. 56).

Three instances of lambda bones appearing to be classifiable as "small Inca bones" in the campo santo collection of 1956 are described and illustrated in an earlier section of this report. Finally, Burial A from the campo santo (in October 1967) provides the one unquestionable *os inca*, a divided occipital (from asterion to asterion) or interparietal bone.

Atlanto-Occipital Fusion and Precondylar Tubercles

In my report on human skeletal material from archeological sites in the Galisteo Basin (Reed, Ms. a), I dealt at some length, giving several quotations, references, and citations, with the topic of union of the atlas (first cervical vertebra) with the base of the skull, rimming the foramen magum. There are three Southwestern cases I know of: one is Burial #129, an adult male, from Las Humanas, and the other two are from Pueblo Largo in the Galisteo Basin and LA:4487 near Manuelito, New Mexico (Reed, Ms. c). In addition, there is one I have seen from just outside the Southwest proper, or at least the Pueblo area, from a site of the Fremont culture at Lapoint, Utah (Reed, 1966b). Probably there are also a number of other instances from the western United States that I do not know about.

Sufficiently comparable to be treated under the same heading with fusion of the atlas is the matter of precondylar tubercles—a lump of bone, or a pair on either side of basion, situated on the anterior portion of the rim of the foramen magnum between the condyles that articulate with the atlas.

Among the Mound 7 series, adult female #163 has a distinct precondylar tubercle, and #214 (female close to age 19) has a pair of small precondylar tubercles. None were observed on crania from the campo santo or in the Pueblo Pardo series (or the material from pithouse excavations).

The outstanding Southwestern example of precondylar tubercles is Burial #26 (a 17-year-old female) from Tse-ta'a in Canyon de Chelly, with tubercles so developed as to form a second pair of condyles, and corresponding double sockets on the atlas (Reed in Steen, 1966). Other instances are Burial #2 from LA:6402 between San Fidel and McCarty's, New Mexico, with a single small median tubercle (Reed, Ms. b), and a pair of small tubercles, placed in front of the foramen magnum instead of on its rim, below basion, on a skull recently examined from the old church at Zuñi Pueblo.

There is at least one specimen from the Plains area in this general category, a specimen from Kansas with the same kind of development as precondylar tubercles—a "small para-occipital process on the left side of the foramen magnum" (S.L. Stewart, 1959, BAE 174).

Precondylar tubercles occur in American (i.e., United States) Whites and Negroes (Broman, 1957), and are comparatively very frequent in Polynesia and Micronesia (Marshall, 1955), with an especially high incidence in a small collection from Eastern Island—five, or 27.8 percent, of 18 male crania (Murrill, 1964).

Another non-pathological anomaly, apparently not uncommon—at least in certain groups—is bridging of the sulcus, or ponticulus formation, on the first cervical vertebra (Selby, Garn, and Kanareff, 1955). Complete bridging appears in the Gran Quivira collection only—as far as noted by me—in Campo Santo Skeleton E, but there is at least one instance of "partial bridging," a conspicuous bony spicule projecting backward from the posterior border of the superior articular process of the atlas of Mound 7 female #404 (fig. 64c).

Perforation of the Gladiolus (Sternal Foramen)

In my Galisteo Basin manuscript (Reed, Ms. a), I do not mention a sternal foramen and so must have missed any instances of perforation in the material covered from that area. The combined series from three sites was large enough that at least a few could be expected, but most of the 36 adult skeletons (including five 17 to 20 years old) were in very poor condition, and frequently little could be determined on the post-cranial skeleton, particularly bones of the torso that are largely cancellous.

Hooton's monograph (1930) on the great collection from Pecos Pueblo does not mention the topic at all, so it cannot be of major importance. The only coverage for Southwestern material which I have happened to encounter is that by Dr. Alice Brues (1946a) on the Alkali Ridge skeletons. She listed the absence of sternal foramen in all seven observable specimens, and cited a genuine anomaly that I have never observed—in specimen H/922 the ossification of the sternum is abnormal, with the division between manubrium and gladiolus one segment lower than usual.

According to Gray's *Anatomy* (1910, p. 159), "At the junction of the third and fourth pieces is occasionally seen an orifice, the *sternal foramen*; it varies in size and form in different individuals and pierces the bone from before backwards."

In the Las Humanas remains, I have noted a perforated sternum in 2 males, #256 and 344 (of 37 specimens well enough preserved for this to be observed) and in 7 females (6 in the Mound 7 collection, and the youthful individual from the pithouse, GRQU-14). Two of eight adult skeletons from Pueblo Pardo also had this feature. The incidence among Mound 7 females is 6 out of 63 observable specimens, or 9.5 percent. In #79 and 198, the foramen is a tiny perforation instead of the more typical larger opening.

Instances I have listed from other sites include: one (a male) from Sapawe in the Chama River area, one (a male) from Atsinna (LA:99 atop El Morro), and one (a middle-aged female with a remarkably tiny perforation) from the mission church at Zuñi Pueblo, as well as a male skeleton found in 1955 at Pueblo Pindi ruin in the Agua Fria section of Santa Fe, and one from the Camino Santander locality in Santa Fe.

In a female adult skeleton from LA:5858, a Pueblo I (White Mound Black-on-white and banded-neck-gray) site near Toadlena, New Mexico, I noted a large foramen in the ossified xiphoid (united fully with the gladiolus). How often this occurs I have no idea, but offhand I do not recall having seen another instance, except for Campo Santo Skeleton E from Las Humanas, with a medium-sized rather than a large perforation of the ossified ziphoid Referring again to Gray's *Anatomy* (1910), however, I find that this is regarded as a normal condition: "The ensiform or xiphoid appendix . . . varies much in appearance, being sometimes pointed, broad, and thin, sometimes bifid or perforated by a circular opening, occasionally curved or deflected considerably to one or the other side" (p. 159, and shown as perforated in figs. 122 and 123).

Bicipital, Bifid, and Cervical Ribs

The right first rib of adult female #163 from Las Humanas is the first bicipital (double-headed) rib I have seen. There is a corresponding facet on the seventh cervical vertebra. For this quite rare item I have no comparative data, except from Alkali Ridge:

> N/922–Sub-adult male. Site 5, Burial 2 . . . Two ribs, a second and third, are fused at the posterior part of the bodies.
>
> N/923–child, 14-15 years. Site 5, Burial 3. The right first rib shows fusion of an anomalous element which extends upward and inward from the middle part of the rib, continuing the natural plane of the bone, and ends in a projection the end of which displays a surface like that on which an epiphysis will later appear. Although it suggests the head of an accessory rib fused to the first, the position in which this extra piece lies would not allow of articulation with any part of the vertebral column.
>
> N/932–Middle-aged male. Site 13, Pit House D. The left first and second ribs are fused at the necks. The seventh cervical vertebra shows an abnormally long costal process which, although fused to the vertebra, may be considered a cervical rib . . . the occurrence of three cases of fused or bifurcated ribs, an anomaly ordinarily so rare that only five cases [including three bifid ribs, see below] . . . in the Peabody Museum collections . . . One specimen from Kwaituki, Arizona, is a typical bicipital rib. This form has been recorded numerous times in White cadaver material. Two cases are reported from prehistoric Mexican skeleton by Hrdlička [description of an ancient anomalous skeleton from the Valley of Mexico, in the American Museum of Natural History bulletin 12 (1899), pp. 81-107]. Another instance in the Peabody Museum collections, from Red Rock Valley, Arizona, resembles this type in having two heads; but the ultimate junction of the ribs is nearly at the sternal extremity and apparently includes part of the costal cartilages, . . . (Brues, 1946a, pp. 327-328).

The last, and two of the Alkali Ridge specimens, are fused ribs, not bifurcated ribs; the Alkali Ridge juvenile and Las Humanas #163, however, seem to be genuine bicipital ribs.

Another costal anomaly is the bifid rib, bifurcated at the sternal end. I have come across one bifid rib in the Southwestern material I have examined, Burial #7 from LA:6402 in the San Fidel-McCarty's locality, excavated in the Museum of New Mexico highway salvage program several years ago. It is a wide and slightly divided rib, intermediate between type B and type W in E.J. Martin's (1960) classification. The other surviving ribs (about half of them) are normal; Martin (ibid., pp. 182 and 186) stated that multicostal occurrences are far more uncommon than individul bifid ribs.

In the Alkali Ridge report Brues also wrote: "the commonest form of bifurcated or fused rib is a bifurcation at the sternal end . . . three cases of this sort are found in the Museum collections, one from New Mexico and two from Egypt" (1946a, p. 328). Not unreasonably, Brues suggested that the frequency of such abnormalities in the Alkali Ridge series and other small isolated local populations may be ascribable in large part to inbreeding. Possibly belonging in the same general category with bifurcated, fused, bicipital, or bifid ribs, are occasional instances of a large or small projection or hook on a rib. The right second rib of Mound 7 female #419 has a broad protrusion, a large point, about halfway along its length. I have recorded at least two other such items, one from the Prewitt highway salvage collection (Reed, Ms. d), and one from a small Fremont (non-Southwestern) series, Burial #8 from the Caldwell site at Lapoint, Utah (Reed, 1966b).

E.J. Martin (1960) concluded that spurs on ribs, forked or split ribs, and ribs excessively widened at the sternal end are varying manifestations of essentially the same abnormality, although mentioning the possibility that some wide ribs may not be related to bifidity. Martin does not mention bicipital ribs. Brues (1946a) regarded bicipital ribs and other forms of bifurcated rib and other forms of bifurcated rib as essentially the same thing.

Presumably not another manifestation of the same kind of thing, the occurrence of a cervical rib (an extra, thirteenth, small rib articulating with the seventh cervical vertebra) is another quite rare anomaly, regarded as a pathological condition–at least, surgical procedure for its removal is prescribed in Gray's *Anatomy* (1910). The first instance that I have seen is in Mound 7 female #418 (left only); another youthful female, #404, must also have had one, as her seventh cervical vertebra has clear and unmistakable facets for the articulation of a rib (again, on the left side only).

Peculiar Bones of the Arm and Foot

The head of the humerus in female #65 of the Mound 7 series is pathological and has been resorbed, apparently largely destroyed by some infection; the scapula is also involved. To a smaller extent the same kind of thing happened to the head of the right humerus of youthful female #418. The distal end of the right humerus and the head of the right ulna of male #11 show peculiar growths, probably osteoarthritic or, conceivably, perhaps representing a healed fracture of the elbow. Mature female #409 shows the same kind of thing (again the right elbow only). Males #256 and 281 and female #163 have slight "arthritic" growths on the olecranon process of the ulna. (Septal aperture of the humerus has already been summarized.)

The bones of the forearm in the Gran Quivira collections are generally quite slender, with strongly developed ridges for muscular attachments, as it typical in Southwestern material. A few of those from Mound 7 at Las Humanas are comparatively sturdy, for example, males #145, 207, 217, and 265. Several from Las Humanas, as well as five of the Pueblo Pardo specimens, are decidedly more curved than average; male #230 and females #165 and 272 in the Mound 7 series and male #15 from Pueblo Pardo in particular are listed as having markedly "bent" ulnae.

The bones of the forearm are synostosed in tiny female #273, with the heads of the radii fused into the lesser sigmoid cavity of each ulna. About the only comparable specimen I have seen –aside from the incredible cripple in the Mound 7 series, male #391–is a small elderly female from the old church at Zuñi Pueblo, in which the bones of the forearm show double upper contact or articulation–growths appear on the bicipital tuberosities of the radii and on the corresponding areas on the ulnae, resembling articular facets. The same ulnae have slight exostoses on the posterior margins of the tops of the olecranon processes.

The distorted and "bumpy" effect of several metatarsals in #418 of the Mound 7 collection has already been mentioned.

In skeleton #275 of the Mound 7 series, the fifth metatarsals are double-headed (fig. 75). This is a large adult male, between 26 and 33 years of age at death, tall but slender-boned, with an unusually slender clavicle. Presumably this individual has six toes on each foot; unfortunately, however, not all of the phalanges were present in this incomplete specimen, making it impossible to determine whether there had been more than the customary 56, but clearly the two heads on each metatarsal both articulated with something.

In the set of five metatarsals in FS-4518 (which also includes several tarsals of a small left foot, presumably female and/or youthful) in the Mound 7 collection, the first is abnormally short, only 40 mm. long instead of between 50 and 60 mm. A comparable, but to me less comprehensible, situation occurs in Burial #6 from Inscription House in northern Arizona–the left fourth metatarsal is abnormally short, only 47.5 mm. long, while the corresponding right is 58 mm. long (Reed, Ms. h).

In a series from Pueblo Largo in the Galisteo Basin (Reed, Ms. a), a more striking anomaly occurs: concrescence of the fourth and fifth metatarsals, in both feet, in specimen 60/15. Comparable items–fused metacarpals–are on record from the Caplen Mound on the Gulf Coast of Texas (Goldstein, 1957, pl. 2, fig. c-3) and from northwest of Del Rio, Texas, but I have not come across a case of metatarsal union similar to that from Pueblo Largo or another instance of two-headed metatarsals like Las Humanas #275.

Types and Affiliations

> According to my report on the material recovered in 1965: The burials (75 inhumations and 31 cremations) from the first season's work at Mound 7, Las Humanas, represent a population essentially of general Ashiwid (Southwest Plateau) type with a few special features distinguishing them from at least the Anasazi of the northern Southwest–lack of pilastering of the femora and of squatting facets on the tibiae, scarcity of perforated humeral septa, several notably high claviculo-humeral indices, somewhat greater stature than usual, and a few cranial details. The crania are metrically quite close to Southwest Plateau material. In general appearance, however, and a few morphological features, largely matters not of presence/absence but frequency or degree (low sutural complexity with very few Wormian bones; low narrow foreheads, particularly high orbits with little slope, nasalia seldom high-bridged) the skulls as a group diverge perceptibly from Ashiwid norms, and there are certain individuals definitely not of Puebloan type physically, and very likely representing intrusion or admixture from the Plains. Cranial deformation of some kind is definitely indicated in at least a few skulls, but it certainly is not cradleboard flattening as found in Pueblo (Mogollon and Anasazi) material. The majority of the crania, in any case, are–aside from postmortem distortion–clearly undeformed.

In study of the larger 1966 collection, the impression of a strong non-Puebloan element was greatly enhanced. Cranial deformation (or the absence thereof) and stature (with many tall individuals), as well as non-southwestern features of skull vault and face, contribute to this. Many individuals are distinctly non-Puebloan in appearance, and resembling Plains types or the Otamid variety.

Finally, in examining the 111 skeletons (46 adults, many of them well preserved or "usable") recovered in the third and last season of excavation at Mound 7 in 1967, I felt much less baffled, and the skulls were either deformed or not, with few questionable specimens. I do not believe this is due entirely to my proficiency increasing with greater experience (although I trust this is happening). Again, many individuals appeared non-Puebloan.

In the sections reporting on the campo santo collection and the small series from Pueblo Pardo, the subject of affiliation receives further treatment; these discussions, written in late 1965 and early 1963 respectively, have not been greatly revised, although they are somewhat condensed. In the Pueblo Pardo material, I thought I saw some connection with the San Simon subtype (of the Southwest Plateau stock) of southeastern Arizona. Among the campo santo crania several individuals struck me as Deneid; Table 47 lists a few of them separately, with comparative data.

The terms "Ashiwid," "Otamid," and "Deneid" are among those used by Georg Neumann (1952). Although his classification has been sharply criticized, it remains the most useful one available. Its flaws or drawbacks are, I feel, minimized by thinking of it not as a set of pigeon holes into which all the material should be fitted, but instead as a series of modes or standards that will be approximated by most of it.

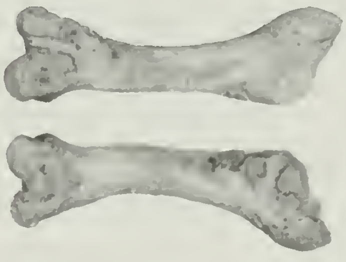
The Ashiwid variety of the Neumann system is identical with Seltzer's (1944) Southwest Plateau stock, but the former is perhaps a broader, more abstract concept, and the Southwest Plateau stock can be regarded as its local expression.

The term Otamid refers to the archaic long-headed type found in very early contexts (e.g., the Midland find in West Texas, the Browns Valley specimen, and the Lansing Man) and found particularly in marginal areas later–the type series for this variety selected by Neumann is a historic period group from the Gulf Coast of Texas.

The Deneid variety consists primarily of Athapaskan speakers and neighboring tribes in the northwestern part of North America–broad-faced, low-vaulted Mongoloids presumably representing a separate immigration at a late time.

The other categories distinguished by Neumann, with which we shall be little concerned, include the Lakotid variety (in the Northern Plains, thought to have been formed by mixture of Deneids with other types), the Lenapid variety (the northeastern long-headed type), the Iswanid variety (widespread in eastern Archaic sites, notably Kentucky shell-mounds typified by the great Indian Knoll collection), and the Walcolid variety (roughly, or primarily, the Gulf type in the Southeast).

Metrically, the crania from Las Humanas, as a group, are not too different from Southwest Plateau Ashiwids (see tables 50 and 51). The male skulls of the Mound 7 collection are quite close



75. Burial 275: inferior view of the two fifth metatarsals, both with two heads.

to the series of 35 undeformed males from Hawikuh, which may be regarded as the type series of the Southwest Plateau stock (Seltzer, 1944). The means for maximum breadth of the cranial vault, maximum bizygomatic width, and face height are higher in the Las Humanas group than at Hawikuh, but the ranges are almost identical. Facial indices are not far apart. Nasal height is slightly greater at Las Humanas, as is the breadth of the piriform aperture, but with an identical range. The nasal index differs only very slightly, and the orbit heights and breadths fall close together. The decidedly non-Southwestern effect is an impressionistic morphological one.

In studying the large collection from Pecos, Hooton (1930) sorted a series of 129 male crania into eight "morphological types" (one, however, being a "Residual" category that comprised 14 skulls not assignable to any of the other seven "types"). The method and theory of this procedure have been sharply criticized, and only rarely has it been followed–notably at Paako, but with a larger number of "Residuals" than any "type" (S.L. Rogers, 1954).

These "types" at Pecos are groups of 5 to 27 skulls with only trifling metrical differences and with morphological characteristics ranging from quite minor to rather striking, falling largely within the normal Pueblo Indian range and undoubtedly representing a single basic original population with considerable admixture from Plains contacts, presumably largely Apache. A few of the most divergent individuals may be visitors or other intruders, and not Pecos people at all.

Hooton's eight groups or "types" can be summarized quickly as follows (the number of skulls from Pecos in each category is given in parentheses):

1. "Basket-Maker" (8)–small face, narrow forehead, poorly developed chin and mandible; leptoprosopic, mesorrhine; relatively high orbits; small stature (range of six, 157.45-167.8 cm., mean 160.5 cm.)
2. "Pseudo-Negroid" (13)–flat broad nasalia, platyrrhiny, pronouncee alveolar prognathism, rounded frontal region; very small stature (range of twelve, 147.8–159.65 cm.; mean 155.25 cm.)
3. "Pseudo-Astraloid" (11)–comparatively heavy continuous brow ridges, depressed nasal root, platyrrhiny, facial prognathism; very low orbits, short face; moderate stature (average of ten, 172.5 cm.; mean of entire Series B, with 100 specimens, 161.83 cm.)
4. "Plains Indian" (24)–robusticity, prominent malars, long concavo-convex nasalia, well-developed mandibles; comparatively tall (range of 18, 155.0–174.3 cm.; mean, 163.7 cm.)
5. "Long-faced European" (18, including a few non-Indian) –compressed or medium malars, long faces and deep mandibles, straight and often high-bridged and narrow noses, high orbits, orthognathism
6. "Pseudo-Alpine" (14)–broad short face, prominent malars, broad short nose, vertical forehead, full temporal regions; europrosopic
7. "Large Hybrid" (27)–massive skulls of larger than average cranial capacity, big (long and also notably broad) faces, heavy projecting malars, heavy mandibles with everted gonial angles; comparatively tall (range of 22, 156.7 to 171.4 cm.; mean 163.7 cm.)
8. "Residual" (14)–generalized, "nondescript," unclassifiable

The first two groups are typical Southwestern Plateau Ashiwids, with only minute differences, morphological or metrical --the second with lower vault heights, smaller cranial capacities, slightly broader and shorter faces, distinctly lower orbits and shorter noses (relatively but not absolutely broader), and longer and narrower palates–but in almost all dimensions, the ranges of these few specimens overlap almost completely. That these two groups represent different ancestral strains, rather than two segments or aspects of a normal range of minor variation, seems extremely unlikely.

In the case of the "Pseudo-Australoid type," however, I believe it reasonable to consider that the combination of prominent brow ridges and nasion depression, relatively short face, low orbits, and broad nose may well represent the survival and reappearance of distinctive features of the archaic Otamid type and of the old "Amurian" or Ainoid element in the original peopling of America. Hooton, in fact, pointed out that his "pseudo-Australoids" do not actually resemble Australians, Tasmanians, or New Caledonians (Melanesian) at all closely, but do manifest rather striking similarities to the Ainu.

Fairly often, individuals of this type–or with features of the type, particularly the strongly developed brow ridges–turn up in the Southwest, from early horizons to late periods, seeming to belong in the general Anasazi population, but representing one extreme of a range or sporadic retention of an archaic trait. Examples include one from a Basketmaker site near Ignacio, Colorado (Reed, 1956, pp. 393–401), the original Rosa phase material (Gabel, 1944), and several Pueblo III specimens from various localities, such as Moqui Canyon in southern Utah (Reed, 1963a) and Pueblo del Arroyo in Chaco Canyon (Reed, 1962b).

A cranium from San Cristóbal in the Galisteo Basin, which is decidedly Otamid in appearance but which I have written up (Reed, Ms. a) as a survival into Pueblo IV of this element in the composition of the Southwest Plateau stock, very possibly should be considered instead as a late arrival, a non-Southwestern individual, representing an extension toward the Rio Grande of the outside accretion or infusion so strong at nearby Pecos and Las Humanas.

Obviously, the "Plains" type at Pecos must be, as labeled, an element deriving from the Plains. It resembles, however, northeastern groups (in the Neumann system, primarily or essentially the Lenapid variety) rather than historic tribes of the Western Plains (Hooton, 1930, pp. 265–266).

The "Long-faced European" type includes a few burials from the church that probably are, indeed, European; the others, no doubt, also represent a Plains influence, very possibly a specifically Apachean infusion–they resemble closely both the "Plains" type (at Pecos) and certain genuine Mongoloid groups, such as Northern Chinese (Hooton, 1930, p. 275). The skull from Paako assigned to the "Long-faced European" type (S.L. Rogers, 1954, pp. 20 and 36) looks decidedly like a Plains Indian, and the measurements and indices of the face, nose, and orbits are most like the Lenapid among type series of Neumann's varieties.

The remaining "types" at Pecos can be thought of as representing various blends and recombinations of Southwest Plateau Ashiwids representing the basic Puebloan stock, of Anasazi culture and of Tanoan language, with the Plains elements.

Located right on the edge of the buffalo plains, Pecos was a large and important pueblo for some 500 years, known historically to have been in contact with Plains tribes. Consequently, it is not surprising that the Pecos material differs a little from other more typical Southwestern series. As a group the skulls from Pecos diverge significantly from the Southwest Plateau type west of the

Rio Grande in the following areas: larger size, especially cranial breadth, and greater vault height; shorter and wider faces, in particular greater bizygomatic diameter; shorter and broader noses; wider orbits; and greater basion-nasion length and correspondingly less prognathism (Seltzer, 1944).

Crania from the early periods at Pecos are the least unlike the Southwest Plateau stock. The "Basket Maker" type is restricted to the early periods (about A.D. 1300-1500), and is missing in Late Glaze times: "This type, together with the 'Pseudo-Negroids' and 'Pseudo-Australoids', seems to form the archaic stratum of the population . . . The 'European' and 'Plains' types increase in importance . . . almost all of the post-Christian [i.e., 17th- and 18th-century] burials are skulls of these types" (Hooton, 1930, p. 226).

Evidently the colony of Anasazi, presumably from the San Juan region, that formed the original settlement and basic population at Pecos was, to a considerable degree, submerged by admixture from Plains tribes. On the west side of the upper Rio Grande, at sites like Te'ewi and Puyé, less extensive modifications, but some influence from Plains element, seem indicated (Reed, 1953, pp. 116-118).

Returning to Las Humanas, there are certain trends faintly observable over the period of some 350 years represented by the Mound 7 burials, although nothing as clear-cut as in the case of Pecos. First, there are a couple of cultural items. For one thing, cremation occurs only in the Late Phase (Hayes, 1980). Then, a somatological feature culturally determined, artificial cranial deformation evidences a definite shift from predominance of occipital deformation in the Early Phase (the first construction period, associated with Glaze A pottery, falling in the 14th and 15th centuries) to preponderantly undeformed, or with very slight and irregular or indistinct cradleboard flattening in the Late Phase (the 16th and 17th centuries).

The material from the campo santo, presumably belonging entirely to the mission period (the middle half of the 17th century), however, includes a number of deformed skulls.

There is also some indication of an increase in stature at Las Humanas during Pueblo IV times, from sizes normal for male and female Pueblo Indians in the Early Phase to perceptibly higher figures in the Middle and Late Phases. In the Middle period (a phase in the history of the Mound 7 structure probably extending from sometime around or before the middle of the 15th century well nto the early 16th), the males range from about 162 to 172 cm. or slightly over, and average 168 cm. (66 1/5 inches), while in the Late period the male range is quite similar, but the mean is 166.33 cm., or 65½ inches. In both Middle and Late times, the female stature averages close to 155 cm. (61 inches), which is above the range of the six definitely identifiable Early Phase females (and one adlitional of somewhat indefinite placement and rather uncertain tature).

In certain specific morphological traits, such as gonial lare, which might be expected to show trends corresponding to the ise of non-Puebloan features (i.e., lack of cranial deformation and reater stature), I have not been able to pick out anytthing signifiant. The only instance of eversion of the gonial angles to a strong enough degree tht I noted "marked" or "pronounced" comes from the Middle Phase, but there are a couple of "moderates" from the Early Phase (actually sub-medium on a general scale). In the Middle and Late groups, as in the Early, most of the mandibles, both male and female, are listed as having very slight gonial eversion, while quite a number show none at all.

Only a few of the measured skulls, all female, come from the Early Phase, so that it is not practicable to show much in the way of trends in cranial and facial dimensions and indices. Possibly suggestive, if scarcely significant statistically or otherwise, is a review of the nasal index: all the leptorrhine and low mesorrhine (below 51 mm.) specimens are Middle or Late, and two of the six very broad-nosed (over 55 mm.) females are two of the only three instances from the Early Phase. This fits, so far as it goes, but that is not very far.

And although most or perhaps all of the individuals which look particularly un-Southwestern come from the Middle and Late Phases, so do most of the few who notably resemble Anasazi specimens and other Ashiwid material. In short, I am unable to make a clear case for increasing Plains impact on a community originally Puebloan.

The pueblos of Las Humanas and Pueblo Pardo, like Pecos, were on the eastern frontier of the Southwest, in contact with the Plains area and the Plains tribes. It is known that Apaches frequently came to Las Humanas, trading and on occasion raiding, during the 17th century. Beyond this, however, it has often been thought that the people of this area, being one of the various unrelated groups referred to in Spanish documents as "Jumanos," were essentially not Puebloan.

A more definite version of this idea is the suggestion that the people of the Jornada branch of Mogollon culture were not Puebloan, but rather a distinct local group influenced by Pueblo culture (Vivian, 1964, pp. 144-147). And this is quite possible although the Mogollon groups in western New Mexico and southeastern Arizona seem to have been essentially Southwest Plateau Ashiwids.

Two of three skeletons from a ruin of Jornada affiliation in Lincoln County north of Capitan Mountain, the "Smokey Bear,' are distinctly non-Ashiwid and can reasonably be aligned with Otamids of western Texas (Reed, Ms.-). A fourth specimen from this ruin—a cranium, collected by a local man and turned into the University of New Mexico—is à brachycranial female of essentially Ashiwid (Southwest Plateau) type. Three skull are undeformed; one (not the Ashiwid-looking cranium) shows moderate but vague and irregular deformation at an intermediate angle.

The female specimen from site LA:2000 at Peñasco Bend (40 miles west of Hope, New Mexico), although quite tall and with individual peculiarities, is essentially of Southwest Plateau type, with occipital deformation (Neumann, 1940). A male skeleton from the Bonnell site northeast of Ruidoso, which I examined for Texas Technological College some years ago, was unremarkable, but evidently Ashiwid (certainly not Otamid) with occipital deformation.

There is, unfortunately, no skeletal material of the period A.D. 1300-1700 known from easternmost New Mexico and western Texas. The archaic Otamid type seems to have survived late in many parts of Texas, and presumably any southern Plains groups antedating the coming of the Apaches would have been essentially of that stock. The "true Jumanos," if there actually was such a group not also known to us by some other name, may have been Otamids; if they were of the Caddoan-speaking Wichita group, this still would be possible, although a more easterly (perhaps Iswanid or even Lenapid?) affiliation might be expected.

A broad correlation between the Athapaskan-speaking tribes and the Deneid physical type is generally assumed. Consequently, any skulls from Pueblo Pardo and Las Humanas that resemble the Deneid variety I take to be of Apache parentage. But in the process of admixture that introduced a very strong Deneid element in the northern Plains tribes (Neumann, 1952), there surely could have been combinations which reversed the outcome, producing groups of predominantly Lenapid or other physical type with a Deneid infusion that, instead of retaining Caddoan, Algonquian, or Siouan language, ended up speaking an Athapaskan tongue. And so the individuals in the Gran Quivira district and at Pecos, of general Plains type but not Deneid, could still conceivably be Apaches.

There also remains the possibility that the Jornada people were not Southwest Plateau Ashiwids, but had at least a tinge or infusion of Otamid. In fact, it is not impossible that the local people of the Gran Quivira district were basically Otamid, and that the Southwest Plateau element is the intrusive one, representing a colony of Anasazi from the north. And the seeming increase of the non-Ashiwid element during the 350 or so years of occupation could then be ascribed to the arrival of people from sites of related culture further south, in the Tularosa Basin and the Jornada del Muerto, which were abandoned between A.D. 1350 or 1400 and 1540 or before, possibly by 1450 (Mera, 1943, p. 15; cf. Vivian, 1964, pp. 145-146). But the trends dimly observable seem to hint rather at an influence from the Plains—whether or not Apache—with mounting impact later in the occupation.

With virtually no skeletal material available either from the late pre-Spanish and early historic periods in the western part of the southern Plains or from south-central and southernmost New Mexico, it is impossible to decide on a selection among these possibilities and reach any firm conclusions on the facial history of Las Humanas, beyond pointing out that the people who occupied that locality during Pueblo IV times were, for the most part, not of the standard Southwest Plateau type of Ashiwid variety, differing to a perceptible degree in a number of minor features from the typical Pueblos (Anasazi and others), contemporaneous and earlier, on and west of the Rio Grande.

18. The Arizona State University Study of Gran Quiviran Physical Anthropology

Christy G. Turner II

The remaining papers in this volume should serve to demonstrate that a large well-dated and well-excavated human skeletal series has more potential information on bone and tooth anatomy and variation of each of these (both within and between time periods), pathology, relevancy to ecology, culture history, and other behavioral correlates than can be studied within a few years by a lone investigator. The command of several data-gathering techniques, plus the analytical possibilities, is a critical limiting factor. This limitation needs to be fully recognized so that these large, valuable, skeletal collections will be treated to the high priority storage and care which they need following initial descriptions if they are to take their rightful place as an inter-disciplinary resource in the study of human variation. The discarding of skeletons to make storage room for pots in museums must cease.

This scientific potential was recognized by Erik K. Reed, Alden C. Hayes, Thomas W. Mathews, and Arthur Thomas, when they agreed to loan the Gran Quivira skeletons to Arizona State University for long-term research in physical anthropology. One condition—safe storage and study space—was met and generously made available by Reynold J. Ruppé, Chairman of the Department of Anthropology. Funds from this department, as well as the Arizona State University Grants Committee, the Wenner-Gren Foundation for Anthropological Research, Sigma Xi, and the National Park Service, aided directly and indirectly in various parts of our activity. Annual graduate anthropology seminars followed receipt of the remains. The massive standard anthropometric and anthroposcopic descriptive and comparative task, which was done in Santa Fe by Reed, was not duplicated, at least intentionally, in Tempe. Instead, non-metric variations, including pathology, microevolution, and behavioral aspects, were concentrated upon, as well as technique development, following the expensive bone preservation schedule for all the bones except a small sample of each individual left untreated for biochemical studies.

It is the nature of the university community, with its diverse resources in faculty, students, libraries and laboratories, that time-consuming and costly experimental projects can be conducted relatively free of deadlines and without too much expense. Advice, books, equipment, and labor can often be borrowed free, and students can participate for long hours in return for advanced training. It is this nearly ideal combination of academic and museum resources that provides a superb model for scientific, intellectual, community, and inter-agency growth and development of anthropology.

Results

Projects

All the Arizona State University Gran Quivira studies carried out from 1967 to 1971 are listed in Table 52. The skeletal series has been used for comparative studies—a fact that is also noted. In the decades to come, it is anticipated that the collection will be many more times that reported here. To date, the Gran Quivira skeletal series is possibly the largest and most extensively studied collection in the Southwest. However, there is no limit to the amount or kind of study such a series can receive. Future projects will concentrate less on macromorphology and increasingly on micro-, and even more reductionistic molecular and radiation probing.

Demographic evidence indicates that the average life expectancy worsened from prehistoric to historic times at Gran Quivira. Long bone x-ray studies may reveal something about the life-shortening stresses involved. In addition, trace-element studies should be just as feasible on bone as on stone artifacts, for which geographical origins are sought and traced. The biological affiliation of individual skeletons might possibly be ascertained as well by such techniques as by morphological resemblances. We will definitely continue our work on discrete dental and skeletal traits in both living and ancestral populations to determine modes of inheritance, so that someday gene frequencies can be calculated in past populations as precisely as they can in the living. This would permit relatively long-term genetic microevolution investigation—something totally impossible at the present. This work will be coupled with the continued use of the Gran Quivira series as one resource for information on dental variation, useful for our standard models for trait variation description. These standardized plaques done in plastic, which went into production in 1968-1969, have been distributed to dental investigators all over the world.

Introduction to x-ray technology and the use of such equipment for a pilot examination of long bones for growth disturbance lines was generously made possible by Dr. Thomas Burch, Phoenix and Sacaton. From that preliminary investigation of about 40 individuals, we have gone on to x-ray all persons with equipment acquired through Department of Antropology funds. The value and potential of this special equipment for bone density and age correlations, dental considerations, and a host of other types of research is outstanding.

The advantages of studying skeletal remains over living samples is that the former includes the opportunity for easy and repeated direct observations on bone and teeth, ease in disassembling and sorting individuals and individual parts for direct comparisons, simplicity in acquiring bone samples for chemical tests, no limitations to x-ray exposure, and finally, no need to be diplomatic. These advantages are possibly overshadowed by two serious drawbacks. First, skeletons cannot be questioned, whereas the living can be asked directly if and where they hurt, how long ago an illness started, and who their parents and sibs are, as well as where they reside, and so forth. Second, cemetery populations cannot be sorted in terms of the degrees of between-individual relationship. At best the most that can be said is that all are related.

The best aspects of both data resources, however, could be combined for microevolutionary investigation. Such a situation would include study of a living population, isolated in an understandable ecologic, cultural, and epidemiologic framework, plus a large sample of their ancestors' skeletal remains sorted into as many temporal units or generations as could be archeologically defined. From the living could be obtained information which is heavily behavior-dependent (health, wealth, rank, residence, occupation, and kinship), and from the deceased could be gathered that which is behavior-free, or if not, inferable from the living (such as work habits).

The research situation at Gran Quivira approaches this ideal, and some study of the living descendent Indian populations, regardless of the degree of non-Indian admixture (because that is a real factor in their microevolution after Spanish contact), is obviously the next major task for Gran Quiviran physical anthropology.

Biological Affiliation

All metric and non-metric trait analyses showed Gran Quivirans to be, as expected, American Indians, and more like Southwestern Indians than like others of North America. Within the Southwestern population, Gran Quivirans showed a somewhat greater similarity with Pecos Pueblo Indians than with Western Puebloans (such as prehistoric-historic Hopi), or they occupied an intermediate position between Hopi and Pecos.

Late Phase cremations hint at extra-village influence, and in-migration was tested for. However, no significant differences could be demonstrated between non-metric trait frequencies of the cremated and those buried *in toto*. Similarly, significant differences could not be found between the age profiles of the two burial classes. Sex could not be identified in enough cremated remains, nor with sufficient reliability, for comparison. Individuals buried *in toto* and those cremated were seemingly drawn from the same biological population. For example, 80 percent of the unburned had mandibular torus—as did 83 percent of the cremated. The chances of Plains Indian admixture as well as that from Athapaskans is difficult to evaluate, since our knowledge of osteological and odontological variation in these two groups is not well developed. If admixture had occurred—and the chances would be in favor that it did—then it was not of significantly high amounts from either Plains or Athapaskans to mask out the inter-Pueblo similarities.

Sex

For the Gran Quivira *total series* received at Arizona State University (see tables 53 and 54) the not unusual proportion of sexes is (sex ? = children and incomplete burials; cremations (table 55) are excluded):

Male	20.4%	(42/206)
Female	29.1%	(60/206)
Sex ?	50.5%	(104/206)

Old adult male and female (over 55) proportions show no significant differences, nor are they as numerous in the *total series* as I expected, but undoubtedly some portion of middle-aged adults (36 to 55) are actually older, there being no absolute criteria for their identification:

Old adult males	3.5%	(7/199)
Old adult females	4.5%	(9/199)
Old adult males + females	8.0%	(16/199)

In the *adult series* (older than 17), the proportion of old adult males and females is more in keeping with my expectations for this kind of population and environment, since there appears to be a slight excess of old males:

Old adult males	21.2%	(7/40)
Old adult females	16.1%	(9/56)
Old adult males + females + sex ?	14.5%	(16/110)

In this last comparison the proportion of old men and women seems ideally suited for the maintenance of a rich traditional body in both sexes of this eastern New Mexican dry-farming culture in a pigmy conifer and parkland biome. The 15 to 20 percent old men and women of all adults in such an economic and technical milieu, whose bones evidence no between-sex effects of intensive infective or work stress and show no marked occurrence of trauma, whose teeth in both sexes are bad (but not unusually so for such cereal-eating people), and whose environment was in no way as demanding or stressful as the cold northern arctic or steamy southern tropics, is the demographic effect of these and many other interacting variables. Diet and health seem to have been as good, if not better, for the total series than even that of food-rich California Indian gathering groups, judging from the fewer growth disturbance lines in Gran Quiviran long bones.

Life Expectancy

The proportion of children who died at 6 years or less is 33.7 percent (67/199)—a figure not much different from other large Pueblo Indian cemetery populations, nor from non-epidemic, pre-antibiotic times among living Pueblo Indians.

The proportion of children aged 6 years or less is greater in the later phase of occupation than in the earlier part. The between-period proportions are:

Historic Period (Late + Middle-to-Late)	35.6%	(37/104)
Prehistoric (Middle + Middle-to Early + Early)	27.8%	(22/79)

A slightly different temporal arrangement maintains the same relationship between Early and Late occupation differences:

Late Period	34.1%	(30/88)
Middle (Middle + Middle-to-Late)	31.3%	(21/67)
Early (Early + Early-to-Middle)	28.6%	(8/28)

The above between-period differences can be interpreted in either or both of two ways. First, the increased proportion of child mortality is real, and is attributable, in part at least, to the disruptive effect of Spanish contact on life expectancy. Communicable disease, starvation, and other stresses may have been much worse after contact and all through the historic period. Second, the differences may not be real. They could be due to differential preservation of infant and young child skeletons through time. In the earlier period disporportionally more of the harder, stronger, nd larger adult skeletons might possibly be preserved. Choosing etween these two alternatives is easy if it is assumed that the dis- upting effects of the Spanish were also hard on old adults as well s on children—that is, the overall life expectancy for the popula- ion was lowered. If there are fewer old adult skeletons in the istorical phase than in the prehistoric one, then the first alterna- ive is acceptable. And that is exactly what happened to the roportion of old adults to all within-period adults:

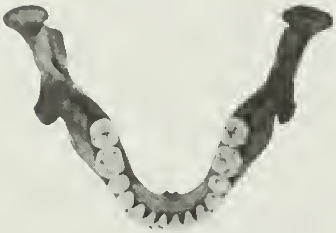
Historic Period (Late + Middle-to-Late)	14.0%	(8/57)
Prehistoric (Middle + Middle-to-Early + Early)	17.8%	(8/45)

The same relationship also holds for this arrangement:

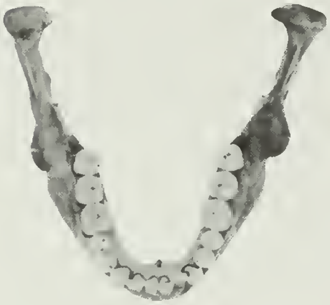
Late Period	16.0%	(8/50)
Middle (Middle + Middle-to-Late)	5.7%	(2/35)
Early (Early + Early-to-Middle)	35.3%	(6/17)

It would appear that life expectancy was lowered in the istoric period of the occupation of Gran Quivira. How much ociological impact this decrease had is difficult to say, but it may ave been significant if the prehistoric demographic profile repre- ented some delicate balance between population size, sex, and age omposition, and environmental pressures involving work force, elf-reproduction, and information preservation.

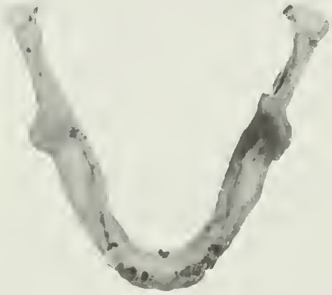
In conclusion, then, it is instructive to note that the emaining reports included here represent an experiment in re- earch and graduate education. It will take more time to complete he evolution of our instructional model of dual training and esearch. Through this "total immersion" approach student and aculty alike have reaped novel and substantial insight into the past ives of one Southwest Indian group, in addition to gaining a work- ng knowledge of the analysis of human biological variation in the roadest sense.



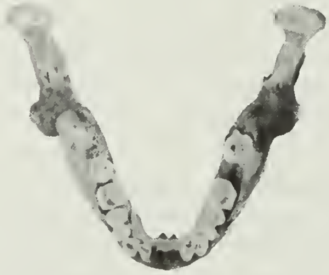
76. Torus Grade 0.



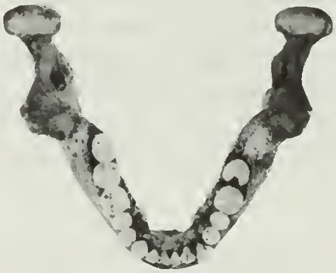
77. Torus Grade 1.



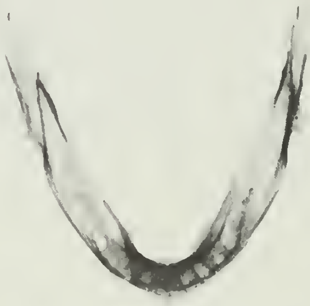
78. Torus Grade 2.



79. Torus Grade 3.



80. Torus Grade 4.



81. Positive x-ray print of Grade 3 torus.

9. The Occurrence of Mandibular Torus

Nancy Tucker Morris

Mandibular torus is a series of bony exostoses that occur on the lingual surface of the mandible near the roots of the canine and premolar teeth. The swellings vary in shape from ridges to cones or welts, increasing in size from posterior to anterior. They extend from the roots of the first or second premolars to the first or second molar, and occasionally from the lateral incisor to the third molar. Mandibular torus always occurs between the mylohyoid ridge and the alveolar border (Hrdlička, 1940, p. 51), and never below the mylo-hyoid line where muscles originate and insert (Van der Broek, 1943). The torus is wholly benign, never occasioning any inflammatory process or bone breakdown (Hrdlička, 1940, p. 23). Sectioned torus swellings are composed of compact but otherwise normal bone (ibid.). The print of an x-ray plate (fig. 81) shows the dense bone cap of a Grade 3 torus.

The torus may be divided nearly vertically or obliquely with parallel grooves of periosteal fibers that attach the soft lining of the bone to the alveolar border (ibid., p. 26). The periosteal fibers hinder uniform torus enlargement, breaking it into a series of ridges that may correspond to the separate teeth or to their roots.

Two general theories have been proposed to explain the cause of mandibular torus: (1) masticatory stress (Hrdlička, 1940; Moorrees, 1957; Hooton, 1918; O. M. Johnson, 1959; Matthews, 1933; Furst and Hansen, 1915) or (2) heredity (Hrdlička, 1940; Krahl, 1949a; Lasker, 1947; Moorrees, 1957; Moorrees, Osborne, and Wilde, 1952; Suzuki and Sakai, 1960; C. C. Johnson, Gorlin, and Anderson, 1965).

The functional or stress explanation assumes that where there is heavy or increased muscular action, the bone responds by thickening or enlarging, as, for example, the temporal or occipital lines on the skull. Hrdlička (1940, p. 38) cites the high frequency of torus among arctic and sub-arctic people whose jaws are unusually robust and strong. Attrition patterns indicate that the greatest stress of mastication falls in the anterior area of the jaw where the torus occurs (ibid., p. 39). This approach, however, does not explain the very low frequency of torus among Australians (0–1 percent).

The second general hypothesis is that there is a gene or genes for mandibular torus. In a study of living Aleuts, Moorrees, Osborne, and Wilde (1952, p. 324) found that there was "an absence of any association [of torus] with toothwear as a measure of function." Additional evidence for a hereditary hypothesis is the difference in the frequency of torus in Eastern (26 percent) and Western (61 percent) Aleuts, populations having comparable diets and habits of mastication, and the high frequency of torus (about 30 percent) in Aleut children (ibid., pp. 324-325). R. H. Osborne postulated at least three independent loci, a major gene, and two modifiers (Moorrees, 1957, p. 60). Suzuki and Sakai (1960, p. 266), from a study of seven pedigrees, concluded that the trait is inherited as an autosomal dominant. C. C. Johnson, Gorlin, and Anderson (1965, p. 435) also suggested an autosomal dominant mode of inheritance; however, they noted that the trait is 30 percent more frequent in females than in males. Akabori (1939b) found the same bias in a sample of 340 Japanese, and Hrdlička (1940, p. 10) pointed out a higher number and greater degree of torus for males in Aleuts, Whites, Negroes, and some Mongoloids. Similarly, Ostiaks (Moorrees, 1957), Norwegians and Eskimos (Schreiner, 1935), and Japanese (Ihara, 1950) have higher frequencies for males. Moorrees (1957, p. 57) found no significant difference for Aleuts, but did note that the degree of torus development tends to increase with age, at least after age 18 (Moorrees, Osborne, and Wilde, 1952, p. 326). Such evidence indicates that the hereditary hypothesis of torus development is probably correct.

Methods and Analysis of Gran Quivira Material

Since personal techniques vary, analytic procedures such as aging and sexing of skeletons, determination of torus classifications, and counting procedures are enumerated here to ensure replicability of analysis.

The sex and age determination of the Gran Quivira material was done by E. K. Reed (Part 7) and independently redone by C. G. Turner II (Part 8, table 53). In the few instances where discrepancies occurred, Turner's estimations have been used. The age classes are given in Table 56.

Variation in torus expression has been classified on a five-grade scale: no torus (Grade 0), slight (Grade 1), moderate (Grade 2), pronounced (Grade 3), and very pronounced (Grade 4). The classes were determined visually and tactually, the accuracy of the determinations was checked by reclassifying arctic skeletal material used by Turner, and then comparing results. Figure 76 shows a normal jaw without torus. A *slight* torus, shown in Figure 77, is palpable but not readily visible, projecting as a slight, single elevation less than $^1/_8$ of an inch in height above surrounding bone mass. A *moderate* torus (fig. 78) is an easily visible cone or series of small cones projecting less than $^1/_4$ of an inch above surrounding bone. A slight or moderate torus generally occurs near the first premolar or canine. A *pronounced* torus (fig. 79) is a large ridge or series of ridges $^1/_4$ to $^3/_8$ of an inch in height, which generally extend from the first premolar to the first molar (see also fig. 81). A *very pronounced* torus (fig. 80) is a complex mass of ridges and cones that projects more than $^3/_8$ of an inch above the surrounding bone. In such cases the bone may be so massive that the growths completely fill the anterior space normally found between the left and right sides of the mandible. The growth does not extend back beyond the first molar, but generally involves the bone structure near the canines.

The presence of asymmetrical torus development in 36 individuals necessitates that counting procedures be standardized. Since it is assumed that the presence of a torus of any size or shape indicates the presence of the torus gene, the largest possible count is desirable. The right side has been used where there is asymmetry, since it gives more total occurrences (two) than the left side. Larger tori tend to occur on the right side of the mandible when there is asymmetry, but there is no positive correlation of size and side preference. Therefore, when only one side of the mandible is available, that side has been counted as part of the sample.

For testing purposes it is assumed that mandibular torus is genetically determined, although the exact mode of inheritance for the gene is not known with certainty. All statistical tests have been done using the various combinations of torus grades (0, 1, 2, 3, and 4) for presence and absence of the trait (torus = 4, 3, 2, 1 / no torus = 0; torus = 4, 3, 2, / no torus = 1, 0; torus = 4, 3, / no torus = 2, 1, 0; torus = 4 / no torus = 3, 2, 1 0). It is hoped that the results of these multiple trials will help to clarify the mode of inheritance of torus. For all statistical tests (chi-square), the level of significance for P is 0.05.

In the Gran Quivira collection at Arizona State University, mandibles or mandible fragments are available for 165 individuals. Since the torus was not found in an individual less than 13 years old, younger individuals are not considered in this study. Careful examinations were made of these mandibles, however, to ensure that no early tori were missed. The lack of torus in children is not the result of a small sample, since there are 44 children with mandibles. Thus, the effective sample size for this study is 121, including 110 adults (over 21 years) and 11 adolescents (13 to 21 years). Fourteen cremations and 107 inhumations are represented.

The archeological skeletal material available for study is divided temporally into three time periods: an Early period, A.D. 1315–1400; a Middle period, A.D. 1400–1550; and a Late period, A.D. 1550-1672 (Hayes, 1980).

Torus Frequencies

Of the 121 usable individuals, 32.2 percent (39/121) are males, 47.1 percent (57/121) are females, and the remaining 20.7 percent (25/121) are of undetermined sex. Distribution of the various grades of torus for males, females, and sex unknown individuals is shown in Table 57. Table 58, which shows the distribution of the torus grades by age classes, sex, and time period, includes all individuals used in this analysis.

Comparison of Sex and Torus Size

In viewing the Gran Quivira material, there seems to be a definite size bias for males, whose tori appear larger. A comparison of torus grade frequencies by sex shows that Grades 3 and 4 occur more often in males than in females (table 59). A separate comparison by sex of each grade of torus shows that there is no significant difference between the sexes (Grade 0, $X^2 = 0.49, P = 0.5$; Grade 1, $X^2 = 0.28, P = 0.6$; Grade 2, $X^2 = 0.53, P = 0.5$; Grade 3, $X^2 = 2.05, P = 0.2$; and Grade 4, $X^2 = 2.07, P = 0.2$). In other words, for Grades 3 and 4, differences of the magnitude seen in Table 59 may be expected to occur one time in five on the basis of chance alone.

Comparison of Age and Torus Size

Since the torus does not first appear until age 13 or older in the Gran Quivira material, it is assumed that there is a correlation between age and torus size. A chi-square analysis shows no significant difference in the occurrence of torus in age classes 6 (21 to 35 years) 7 (36 to 55 years), and 8 (56 to 75 years) for either males or females, as can be seen in Tables 60 and 61. There is a positive correlation of torus size and age ($r = 0.66$) using the average of each age class as the age.

The correlation of size and age, as well as the lack of torus development in children younger than age 13, indicates that environmental factors may play some part in torus expression. However, age-dependent trait activity, such as gout, usually is attributed to genetic causality. If environmental factors are involved, the torus development may be triggered by the onset of puberty and the resulting changes in body chemistry.

Comparison Within the Late Phase

Cremations are found only in the Late period. Thus, it is likely that the practice, which appears so suddenly and in such high frequency (51.2 percent, or 149/291 of the burials in the Late period were cremations), is the result of new cultural influences. If these were caused by the migration of culturally distinct people into Gran Quivira, then possibly these people were also biologically distinct. A comparison of torus presence and absence for cremations and inhumations (table 62) shows that there is no such significant difference ($X^2 = 0.31, P = 0.7$). Thus, with this trait, no biological differences can be demonstrated. It is therefore permissible to pool cremations and non-cremations in order to obtain a larger sample size for torus.

Comparison Between Time Periods

Although no statistically significant differences in torus frequency were found between males and females, pooling all periods and ages, an analysis between time periods was done separately for each sex. For males (table 63), there was no significant difference comparing Early to Middle with Late, Early with Middle to Late, or Early with Late. For females (table 64), however, there was a significant difference comparing Early and Middle with Late ($X^2 = 4.26, P = 0.025$), and for Early compared with Late ($X^2 = 3.79, P = 0.05$). This seems to indicate that the incidence of torus changes more through time for females than for males. Small samples in the Early periods (only six males and six females) must be considered in such statistical calculations.

A comparison of torus incidence between sexes for each time period shows no significant differences for presence and absence of the trait (tables 65, 66, and 67).

Torus frequency increases from the Early to Late periods: Early, 66.7 percent (8/12); Middle, 67.7 percent (21/31); and Late, 83.3 percent (56/67). For the site as a whole, this is an increase of 17 percent in 325 years. This trend could be caused by selection, drift, admixture, inbreeding, mutation, errors of sampling distribution, or various combinations of these. This simple trend suggests selection, which for the site as a whole is about a 1-percent change in frequency per generation—a low rate of change. At present, there is no evidence for torus linkage. If this trend could be followed through each of the 16 generations, selection would be more likely to explain such a steady rate of change than drift. Slow, straight line drift is theoretically possible, but highly unlikely statistically. (The chances of random movement in only one direction through 16 generations is 0.5^{16}). However, it is not possible to work within the framework of individual generations, since phenotype frequencies are available only at one point in each time period. Therefore, the assumptions of a steady rate of change may be invalid, and factors other than selection may be operating.

In the 150 years of the Middle period, a 1 percent change in torus frequency occurred, whereas a 15.9 percent change occurred in the 125 years of the Late period—which is a larger shift in frequency over a shorter period of time. Such rapid shifts in frequency in small groups are often attributed to genetic drift, where near extinction can lead to gene loss or fixation (Wright, 1931, p. 135). That such circumstances may have affected the Gran Quivira population is corroborated by historical occurrences during the Late Phase. By the early 1600's, the Spanish were just beginning to make contact with the Indians in the region. Vivian (1964) suggested that not only did the first contact with Whites frighten many Indians away from the area, but also that it may have resulted in the deaths of many others from disease, warfare, and enslavement.

The first occurrence of cremations in the Late period indicates that new non-Catholic forces were operating at Gran Quivira, since cremation was then forbidden by the Catholic Code of Canon Law. However, there are no known groups in the area with a torus frequency high enough to have increased those at Gran Quivira by 17 percent. Even the other Eastern Pueblo groups, which have the highest known torus frequency in the Southwest (about 64 percent at Pecos), have 17 percent less torus than occurs at Gran Quivira in the Late period.

Inbreeding may be used to explain a decrease in phenotype frequencies, but without pedigrees or accurate ethnographic data, inbreeding cannot be evaluated. It is also highly unlikely that mutations caused the increase in torus frequency, since the average mutation rate per gene for man is assume to be 10^{-5} (Muller, 1950, p. 54).

The problems of sampling distribution are difficult to evaluate. It is unlikely that the archeologist digging the site biased the sample for torus, although some skeletons were not preserved. It may be assumed (Hayes, personal communication) that those not saved were either young children (none of whom have shown torus) or very badly preserved individuals. Since the mandible is frequently intact after inhumation, those jaws having torus, and thus extra strengthening, are possibly more likely to be preserved. Although the entire Gran Quivira site was not dug, it is unlikely that this would bias the sample, since differential burial treatment based on the presence of torus is improbable.

The nature of sampling as a mathematical process, however, may have biased the analysis in two ways. First, in any diachronic analysis, the basic problem is to define the population being sampled. At Gran Quivira such a definition is suggested by the archeology of the site, which allows a temporal division of the skeletal collection into three periods. However, it may not be legitimate to consider the individuals within a single time period, which extended at least 100 years, as a single population. Second, by definition, any sample represents a single moment in time for the population from which it is derived. Repeated sampling through time may allow an analysis of process. Such an analysis of the Gran Quivira material is based on average torus frequencies for each of the time periods. These averages are used as single moments in time for the purpose of statistical analysis. However, they do not reflect fluctuations in frequency that may have occurred within each period. Thus, the individuals in each sample may not be representative of the populations from which they are taken. Because of the nature of archeologically recovered data, however, such assumptions are necessary to allow an analysis of the material.

Other biasing factors may have resulted from the temporal divisions used. That there may be no biological reality to the three periods described by the archeologist is a natural problem of working with prehistoric material, where relevant biological facts, such as pedigrees or migration data, are not available. The characteristics that the archeologist sees as diagnotic of distinct cultural periods do not necessarily correspond to biologically distinct populations.

Asymmetry

Of the 94 bilateral tori, 37 are asymmetrical in size. Table 68 shows the numbers and sizes of these asymmetrical tori by sex. Four different assumptions of torus inheritance and the effects of environmental factors may help to explain these asymmetrical tori: (1) the torus gene may determine the maximum size of development; (2) the torus gene may determine the minimum size of the torus; (3) the torus gene may determine only presence or absence of the torus; or (4) torus may be inherited in a complex manner.

If it is assumed that the gene determines maximum or minimum size of torus, a smaller (or larger) development on one side may result from outside forces reducing (or increasing) the full expression of the gene. If the gene merely determines presence or absence of the trait, and if environmental or developmental conditions determine the size and shape, then size differences are not the phenotypic expression of genotypic differences. This would make a Hardy-Weinberg analysis invalid. If the torus size is determined by the genotype of the individual, the existence of asymmetry may indicate a complex mode of inheritance, possibly three alleles or several interacting systems.

Genetics

Suzuki and Sakai (1960, p. 267) and G. C. Johnson, Gorlin, and Anderson (1965, p. 438) suggested that mandibular torus is determined by an autosomal (dominant) inheritance of two genes. It is worthwhile calculating gene frequencies to test a simple model of inheritance: two-allele, autosomal non-dominant. A non-dominant mode of inheritance is tested because there is a continuous range of morphological expression for torus, and not discrete categories as in a simple dominant such as the PTC taste test. In addition, the determination of a dominant-recessive model of inheritance here would necessitate pedigree data to distinguish the phenotype classes. A two-allele system is suggested because there are five phenotypic classes of torus, whereas a minimum of six are necessary for a three-allele model. Autosomal inheritance is assumed because no sex linkage has been shown in this material.

The five phenotypic classes of torus (Grades 0, 1, 2, 3, and 4) are arranged into three genotypes (all five possible ways are given), and the gene frequencies are calculated. In accordance with the principle of Hardy and Weinberg (assuming equilibrium), the genotype frequences for two alleles, p and q, will be $p^2 + 2pq + q^2 = 1$. Adjusting the values for the number of individuals in the sample gives the expected number of individuals in each genotype. Table 69 shows the respective goodness of fit analysis. Only the second grouping shows no significant difference between observed and expected frequencies. This indicates that if torus is inherited as a two-allele, autosomal non-dominant, Grade 0 represents one homozygous condition, and Grades 3 and 4 the other, with Grades 1 and 2 being heterozygous. Therefore, the frequency of *q*, the gene for torus, is 0.495 for Gran Quivira (27+27+66/242 = 0.495). Thus, it can be seen that one model than can be constructed to explain the observed variation does, in fact, fit the data. Without pedigree or family data, however, it is not possible to determine absolutely if this model is accurate. The application of a similar model of two genes of cumulative effect (Moorrees, Osborne, and Wilde, 1952, p. 327) did not fit pedigree data from two Aleutian populations, thereby suggesting to the authors that "at least 3 independent loci" were operating (ibid.).

Although this genetic analysis of the Gran Quivira material does not indicate that a complex mode of inheritance need be discussed, other conditions must be considered. For example, the expression of torus is not uniform on all mandibles. Too, the instance of bilateral size asymmetry and varying shapes of torus (single and multiple exostoses) indicate that other genetic factors may be involved. Differential sex penetrance, which is not observable in an archeological population such as Gran Quivira, might be visible if pedigrees were available. Torus shape may be determined by another allelic system or a third allele at this same locus.

It is important to remember that the continuous variation that was observed in the torus is classified into arbitrary classes. On inspection it is obvious that a non-dominant system is the simplest mode of inheritance that will explain such variation. It must be noted with respect to Hardy-Weinberg analysis that inbreeding and admixture are not considered, and that the population (*N* = 121) is not large.

Torus Function

Although it has been suggested in this report that the torus is an inherited trait and is not "caused" by mastication stress, this does not preclude the possibility that torus has a function. The distinction between cause and function is subtle but important. A trait which has morphological variability may have an adaptive significance related to its function (Grant, 1963, p. 117). Thus, while torus serves to strengthen the mandible, it is not caused by stress. As a strengthening feature torus may be analogous to the simian shelf seen in non-human primates.

Assuming that torus does strengthen the mandible, it is difficult to understand why there is so little torus in Australians, whose teeth are heavily worn (Campbell, 1925). Furthermore, there does not appear to be any behavioral explanation for the high frequency at Gran Quivira. What adaptive advantage the trait could have had for this group, and for Pecos, that did not exist for other prehistoric Indian groups in the Southwest is difficult to determine. Any working of reeds or grasses for basketry or other weaving is certainly as prevalent in other Southwestern groups as it is for Gran Quivira. Most probably the adaptive significance of torus is very low.

General Occurrence of Torus

No definite instances of mandibular torus have been documented for sub-human primates, but there are many instances reported for fossil man. Except for the Swartkrans remains, where one incidence of torus is noted, there is no complete description of the Australopithicine mandibles (Day, 1965, p. 188). Torus occurs on at least two Sinanthropus mandibles (Weidenreich, 1936, pp. 52-53), on the Chancelade skull (Vallois, 1946, pp. 180-181), and on a *Homo erectus* from Ternifine (Day, 1965, p. 103). There is also a torus on the Montmaurin mandible (ibid., p. 57), which is Neanderthaloid, as well as on the Kanan mandible (ibid., p. 147), thought to be an African Neanderthal. No instances of torus are noted for any of the early hominoid fossils such as the Dryopithecine material. This occurrence of torus throughout the hominid fossil record suggests its potential importance as a hominid indicator.

In living groups, the mandibular torus is least frequent in Australians (0-1 percent) and most frequent in Mongoloid people (averaging 20 percent), particularly Eskimos (20-100 percent) and other groups living in the polar regions such as Aleuts and Lapps (Campbell, 1925; Hrdlička, 1940).

Comparison with Arctic Groups

The Arctic material included in Table 70 shows the highest frequency for any known groups. Since the procedures of torus grade classification have been standardized with Turner and Becker (1968), all four grades of torus may be used for comparison. The Gran Quivira frequency is not only higher than all the Arctic groups (except the Western Aleuts and the Sadlermuit Eskimo), but it is also double the frequency for Arctic or Southeastern Alaskan Indians.

Comparisons with American Indian Groups

A comparison of Gran Quivira with other American Indian groups is given in Table 71. The use of two sets of figures for Gran Quivira is an attempt to adjust the Gran Quivira measurements to be more comparable with Hrdlička's (1940) figures, which use sight alone to determine the presence of torus.

Even considering the lowest frequency for torus at Gran Quivira (50 percent), which includes only tori easily observed on the skeletal material, the frequency of torus for Gran Quivira is much higher than the frequency for other American Indian groups, with the exception of the Indian Knoll material from Kentucky (Snow, 1948), where no textural information concerning the definition of torus was included to allow an evaluation of technique. Snow's tabular data indicated the more frequent occurrence of "small" tori, 117 for males and 89 for females, with fewer "medium" tori, 17 males and 11 females (ibid., p. 437). This indicates that a third class of "large" tori was conceived but not used. Possibly these classes relate to the slight, moderate, and pronounced grades used here. If the two Kentucky series are combined, an intermediate value of 46.5 percent (253/544) is obtained, which is still 3.5 percent lower than the low frequency for Gran Quivira. The unusually high frequency at Gran Quivira is again evident.

Comparison with Hopi Material (Western Pueblo)

A more detailed statistical comparison was made between the Gran Quivira material and a prehistoric Hopi series (Turner, Ms.). No comparisons were made for children or adolescents, since the Hopi data included no one under the age of 18. It is obvious from Table 72 that the differences between the Hopi and the Gran Quivira material are highly significant, which indicates that the

Hopi and the Gran Quivira samples are not drawn from the same universe. The torus frequency at Hopi is 35.1 percent (33/94).

Comparison with Eastern Pueblo Groups

At Pecos Hooton (1930, p. 125) noted a 14 percent torus frequency (20/142) for males and 15.3 percent (17/111) for females, as well as an additional "lesser development" of 54.2 percent (77/142) for males and 43.2 percent (48/111) for females. From other descriptions by Hooton, these "lesser developments" correspond to Grades 1 and 2 of this system. Pooling males and females gives a total torus frequency of 64.3 percent (162/253). This is much higher than for other Pueblo groups (24.3 percent, or 128/253 as reported by Hrdlička) or Hopi (35.1 percent, or 33/94). This high frequency at Pecos suggests that there may be biological connections between Pecos and Gran Quivira. The high torus frequency may be a diagnostic characteristic of "eastern Pueblo" groups.

There is a low incidence of torus at Cochití, another New Mexican pueblo. From Cochití site 6455, 46 skeletons were removed, 5 of which showed mandibular torus. This is a frequency of 10.8 percent (Heglar, 1968, p. 289). This group may be more closely related to the other Pueblo groups along the Rio Grande (see table 65), where torus frequency is only 24.3 percent. However, the torus illustrated in Heglar's text (ibid., p. 295) was larger than any found in the Gran Quivira series and as large as the largest Aleut or Eskimo in the Turner and Becker (1968) material.

Comparison with Time Depth

Hrdlička (1940, pp. 4-5) tabulated a summary of frequencies for "neolithic and later groups." This includes information about living and skeletal populations that may not be directly comparable, since in the living people a slight torus is likely to be concealed by the overlying soft tissue. Hrdlička tried to remedy this by recording only those tori that could be easily seen, that is, he did not use palpation to detect very weak tori as was done by this investigator (ibid., p. 3). Hrdlička's method of classification should make the living and skeletal material more comparable. Even after this adjustment there is a distinct difference between Hrdlička's (ibid., p. 11) data on skeletal Aleuts (52.3 percent with torus) and Moorrees' data on skeletal Aleuts (63.4 percent with torus) and on living Aleuts (35 percent with torus) (Moorrees, 1957, p. 64). These data indicate a decrease in torus frequency through time. A decrease in frequency from prehistoric skeletal series to recent living groups is also noted by Hrdlička (1940, pp. 4-5) for Scandinavia and Japan. This contrasts sharply with the 17 percent increase noted for Gran Quivira. At Pecos there was no trend visible, although torus frequencies do fluctuate through time.

Summary

The high frequency (77.7 percent) of mandibular torus found at Gran Quivira is unexpected, since the average frequency for American Indians is about 15 percent. The closest prehistoric groups with large samples that can be compared with Gran Quivira are Hopi (35.1 percent with torus) and Pecos (64 percent with torus), both of which are lower. The frequencies at Pecos and Gran Quivira are much higher than for any other American Indian group known. Possibly Pecos and Gran Quivira formed an "Eastern Pueblo complex," an idea that is unsupported at the present time because of a lack of detailed biological information on other groups in the New Mexico area.

A general increase in torus frequency through time is noted at Gran Quivira, which is contrary to trends indicating a decrease in frequency in other groups, for example, Scandinavians and Aleuts.

There seems to be a direct relationship between increasing age and increasing size of torus, which might suggest a functional causation for torus. However, it seems most likely that there is a genetic basis to mandibular torus. The Gran Quivira material seems to fit a simple non-dominant mode of inheritance with no greater penetrance by either sex. Although expressivity in males appears to be greater than in females, this depends on the method of grouping morphological variations. The correlation of age and torus size, as well as the existence of some asymmetry of torus size, suggests that there may be a more complex association between the gene for torus and the actual development of the torus. The mode of inheritance may be complex or environmental factors that may be buffering the expression of the genotype.

10. A Stature Reconstruction of Skeletal Population

G. Richard Scott

In reconstructing the biological profile of a human skeletal population, an initial consideration is body build or physique. Two major components of this are height and weight. A formula estimating living weight from bone weight would be tenuous, even if skeletal preservation were uniform as in a cadaveral series (Baker and Newman, 1957), and would be wholly unreliable if applied to an archeologically derived sample where bone had undergone extensive physicochemical alteration. Long bone length—not subject to such marked post-mortem change—shows a high positive corelation with stature. This has enabled researchers to derive relatively accurate regression formulae for the estimation of stature within various racial groups (for a review see Krogman, 1962). Although data on reconstructed stature are not as precise as the actual long bone measurements, they do allow the comparison of skeletal and extant populations.

When stature estimates are made for a skeletal population demarcated into time periods, any significant temporal changes may reveal new genetic and/or environmental influences on the population. Thus, a stature reconstruction of the Gran Quivira skeletal sample is a potentially useful aid in making historical interpretations about the population. Such a study can be delineated as follows: (1) determine the stature formulae most applicable to Southwest Indian populations, (2) ascertain the degree of intrapopulational variation in stature relative to age, sex, and time period, (3) compare the stature of Gan Quivirans to other Southwest Indian populations, both skeletal and living, and (4) discuss the relative effects of heredity and environment on stature and the possible historical consequences of these factors on the height of Gran Quivirans.

Method

Sample

Stature estimates have been computed for a sample of 89 individuals (34 males, 55 females) from the Gran Quivira population. As most formulae are derived for application to individuals who have attained maximum stature, only those over 18 years of age were considered. Table 73 shows a breakdown of the sample by age, sex, and time period.

Measurements

Long bones were measured on a standard osteometric board calibrated in millimeters. The accuracy of this instrument was checked with a standard-length master gauge. All measurements taken were maximum length and were made according to the procedure outlined by Hrdlička. When a bone was damaged to the point of impeding exact measure, it was excluded from the study. Asymmetry in length between left and right bones was handled in the manner initially suggested by Trotter and Gleser (1952), that is, averaged rather than recorded separately.

Stature Formulae

Since long bone proportionality is highly variable between populations, it is necessary in reconstructing the stature of a skeletal population to use regression formulae derived from a racially similar sample. Because only the formulae presented by Genovés (1967) are strictly applicable to American Indians, earlier authors had to rely on the Pearson (1899) or Trotter and Gleser (1952, 1958) formulae for this racial group. All three formulae have been applied here to test their relative reliability.

Karl Pearson derived the first regression formulae for stature reconstruction in 1899. In that study, he used data on French cadaveral and long bone measurements obtained by Rollet in 1888. This sample consisted preponderantly of aged individual from southern France, where average male stature is around 165 cm. (Deniker, 1903). For these reasons, Pearson's formulae tend to underestimate the stature of taller northern European individuals, but when applied to shorter, stockier individuals such as Corsicans, the formulae, according to Wells (1963), are more reliable than the Trotter and Gleser White formulae (1952, 1958). This might suggest that the Pearson method would be the preferred one for American Indians if these two sets of White formulae were the only ones available.

In 1958 Trotter and Gleser updated their 1952 formulae for White and Negro males and were also able to calculate formulae for Mongoloid and Mexican males. Unfortunately, however, the one for Mongoloids was based on 92 individuals of extremely varied racial origin (e.g., Filipino, Hawaiian, Japanese, American Indian, and others). The authors were careful to note that these formulae were only tentative until the sample could be improved, but despite this inadequacy the Mongoloid formulae have been applied to American Indian males, whereas female estimates were based on the 1952 White female formulae.

Genovés (1967) derived regression formulae based entirely on an American Indian sample. Although 235 cadavers were measured, he was highly selective and used only indigenous individuals who were blood type O and Rh-positive. This restricted the sample size to 22 males and 15 females, but he found evidence of increased homogeneity within the sample. Male and female tables of long bone-to-stature ratios and three formulae presented by Genovés can be used in making stature estimates. (A misprint appears in two articles on this subject—Genovés, 1966, p. 41, and 1967, p. 76.) The formulae utilizing all long bones give stature estimates of about 280 cm. for males and 120 cm. for females. This is apparently not the result of a misplaced decimal or coefficient, since many combinations were tested.

To test the relative reliability of the three sets of formulae discussed above, mean maximum lengths of the femur, tibia, humerus, and radius were extracted from data on the Southwest

Indian populations of Gran Quivira (this study), Pecos (Hooton, 1930), and Point of Pines (K. A. Bennett, 1967b). These figures were then inserted into the four respective single bone formulae given by Genovés (1967), Trotter and Gleser (1952, 1958), and Pearson (1899). The result of this procedure is to give four stature estimates for each sex within each of the three populations relative to the formulae of the three authors. If long bone proportionality between these Southwest Indian groups and the samples used in deriving the regression formulae is similar, there should be little variation in the estimates given by the four bones. To measure the degree of variation in these estimates, variance (s^2) was computed for each author's set of formulae by population and sex. When variance equals zero, this indicates that all four bones give the same estimate of stature; increasing values of variance show the degree of discrepancy among the four estimates.

It can be observed in Table 74 that the use of the Genovés formulae results in the most consistent, or least variable, estimates for both sexes in all populations. The Pearson female formulae appear to be more applicable to these Southwest Indian populations than those of Trotter and Gleser, apparently because the latter were based on the 1952 study of taller American White females. Conversely, the male formulae of Trotter and Gleser were derived from Mongoloids, although heterogeneous, and these were more consistent than the Pearson formulae calculated from short European males. It is unusual that the Pearson and Genovés methods, despite their differences in reliability, give similar results that diverge several centimeters from estimates based on Trotter and Gleser.

K. A. Bennett (1956b) also concluded from his study of the Point of Pines material that the method of Genovés is preferred to that of Trotter and Gleser for reconstructing the stature of Southwest Indian populations. The analysis of data on Gran Quivira and Pecos supports this contention. E. K. Reed (Part 7) employed the Trotter and Gleser formulae to reconstruct the stature of Gran Quivirans before the Genovés formulae became available. If the test of proportionality performed here is an accurate guideline, then Reed's procedure (using the Trotter-Gleser formulae) could have overestimated the height of this group by about 3 cm.

Results

For analysis, two types of data are utilized: (1) actual measurements taken from the six long bones, and (2) stature estimates derived by using the measurements and the three above-mentioned sets of formulae. The use of formulae invokes a source of error between the metric data and stature estimates, so these are considered separately.

Long Bones

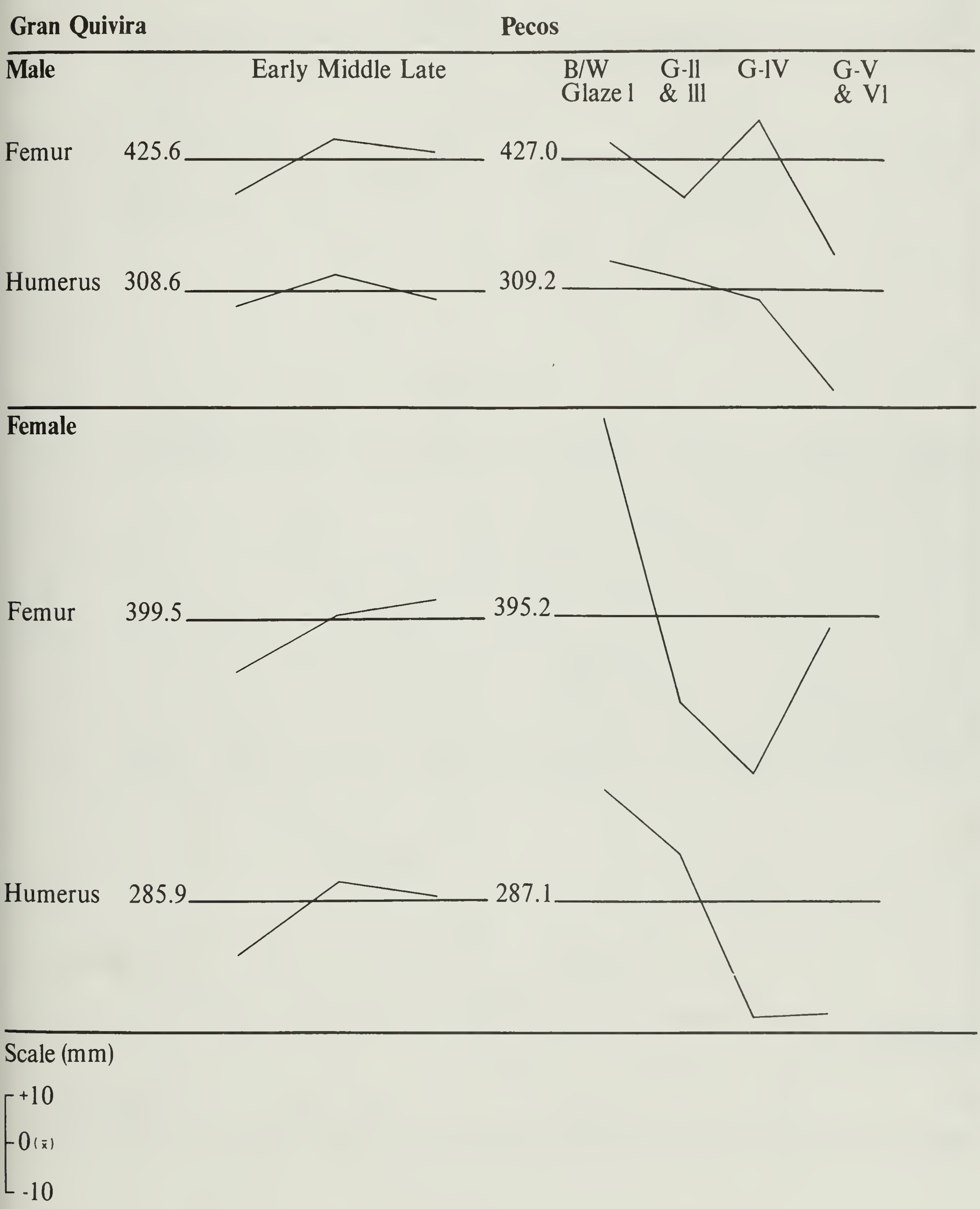
Long bone measurements were compared between sexes, age categories, and time periods. As stature, and hence bone length, are secondary sexual characteristics, there are highly significant sex differences. For this reason, males and females will always be treated as separate units. Because the precise age of a skeleton cannot be determined, only age categories can be compared for each sex. These categories contain those individuals in the age ranges of 18-35, 36-55, and 56-75. The attainment of maximum stature is followed by some decrease in height with aging, but this is due to the degeneration of articular cartilage and compression of the fibrocartilaginous intervertebral discs, rather than long bone resorption. Because there was no significant difference in long bone length between age categories, these were combined for each sex.

Hayes (1980) has assigned most of the Gran Quivira specimens to one of three major time periods: Early Phase (A.D. 1315-1400), Middle Phase (1400-1550), and Late Phase (1550-1672). A few individuals could not be definitely placed in one of three time horizons, so they were categorized as Early-Middle or Late-Middle. As in most archeological sites, the scantiest skeletal remains come from the earlier periods; thus, the Early-Middle individuals have been placed in the Early category, and Late-Middle individuals in the Middle category. This appears to be a fair procedure and does result in a more equitable distribution of individuals within each time period.

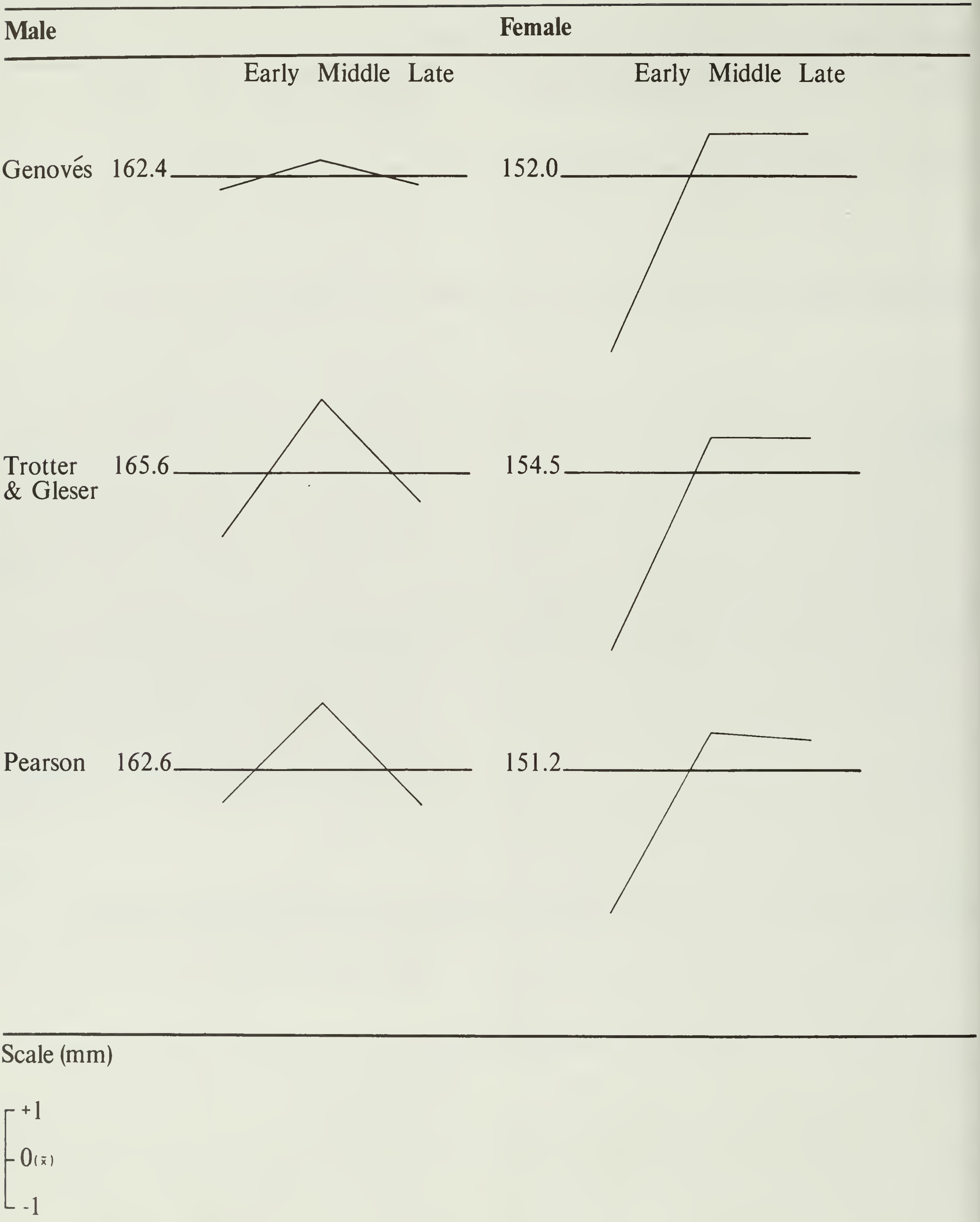
The data for each long bone, divided by period and sex, are presented in Table 75. For males, the femur, tibia, fibula, and humerus all exhibit a minor increase in length from Early to Middle and then tend to decrease slightly in the Late period. Changes in length of the radius and ulna do not correlate with the other long bones, but decrease from Early to Middle and continue to decrease from Middle to Late. Female long bones show an even greater increase in length from Early to Middle, but there is a tendency to stabilize from Middle to Late, with particular bones showing only minor differences between the last two periods. In females the bones of the forearm do not decrease in length through time but show a correlation with the other long bones. The increase in long bone length for both males and females from Early to Middle is not statistically significant for either sex. From this, one could plausibly argue for internal homogeneity through time, but the fact that males and females exhibit a similar increase may allow a genetical and/or environmental interpretation for the change if these are suggested by other lines of evidence, for example, metrical and non-metrical traits, pathology, and so forth.

The skeletal material recovered at Pecos was also subdivided into temporal samples (Hooton, 1930). In this population, the length of male long bones changes discordantly through time, that is, the femur and fibula, the tibia and humerus, and the ulna and radius pairings tend to correlate. It seems unusual that the bones of the lower leg (the tibia and fibula) do not change in a similar manner. One commonality for all male long bones is that they are the shortest in the final or Glaze V-VI period after being relatively stable in the three earlier periods. Female measurements are notably more variable through time than those for the males. By far the longest measurements are found in the earliest period (Black-on-white-Glaze I), followed by a marked decrease in the intermediate periods and a partial recovery of length in the final period (Glaze V-VI). In view of the above it seems odd that Hooton (1930, p. 178) reported that the females "present an exceptional constancy in stature."

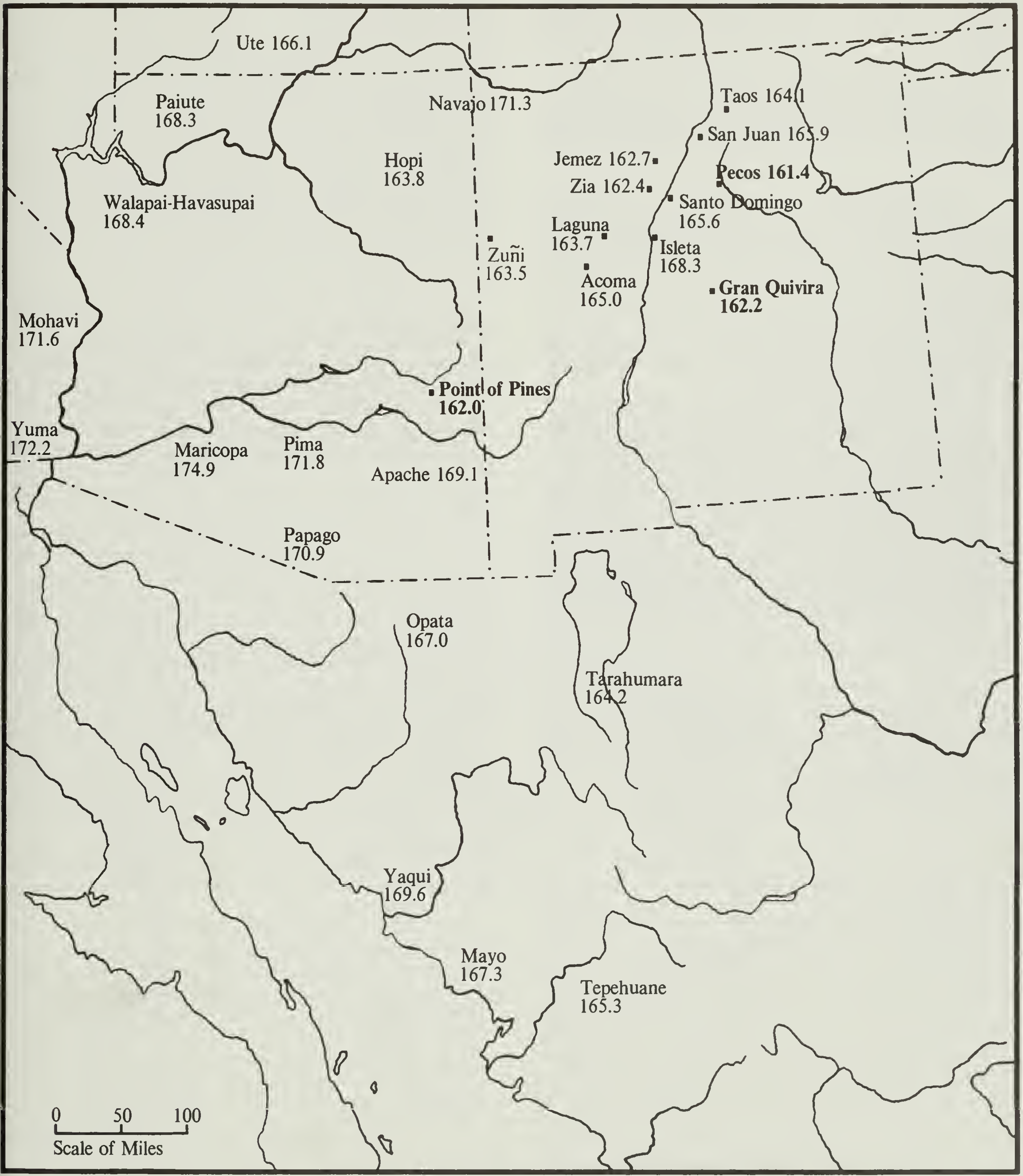
Temporal changes in the length of the femur and humerus at Gran Quivira and Pecos are illustrated in Figure 82. The horizontal lines on the graph represent the mean length (in mm.) of that bone in the population, and can serve as a point of reference for the mean lengths plotted for each period. One can observe that the two populations exhibit somewhat different temporal changes in bone length—the Pecos measurements decrease, while those of Gran Quivira slightly increase. Furthermore, long bone length for males from each population is much less variable through time than it is for females. Table 76 presents mean maximum lengths of the



82. Temporal changes in the maximum length of the femur and humerus in the Gran Quivira and Pecos skeletal series.



83. Temporal changes in stature (estimates) at Gran Quivira between A.D. 1315 and 1672.



84. Distribution of male stature among Indians of the American Southwest.

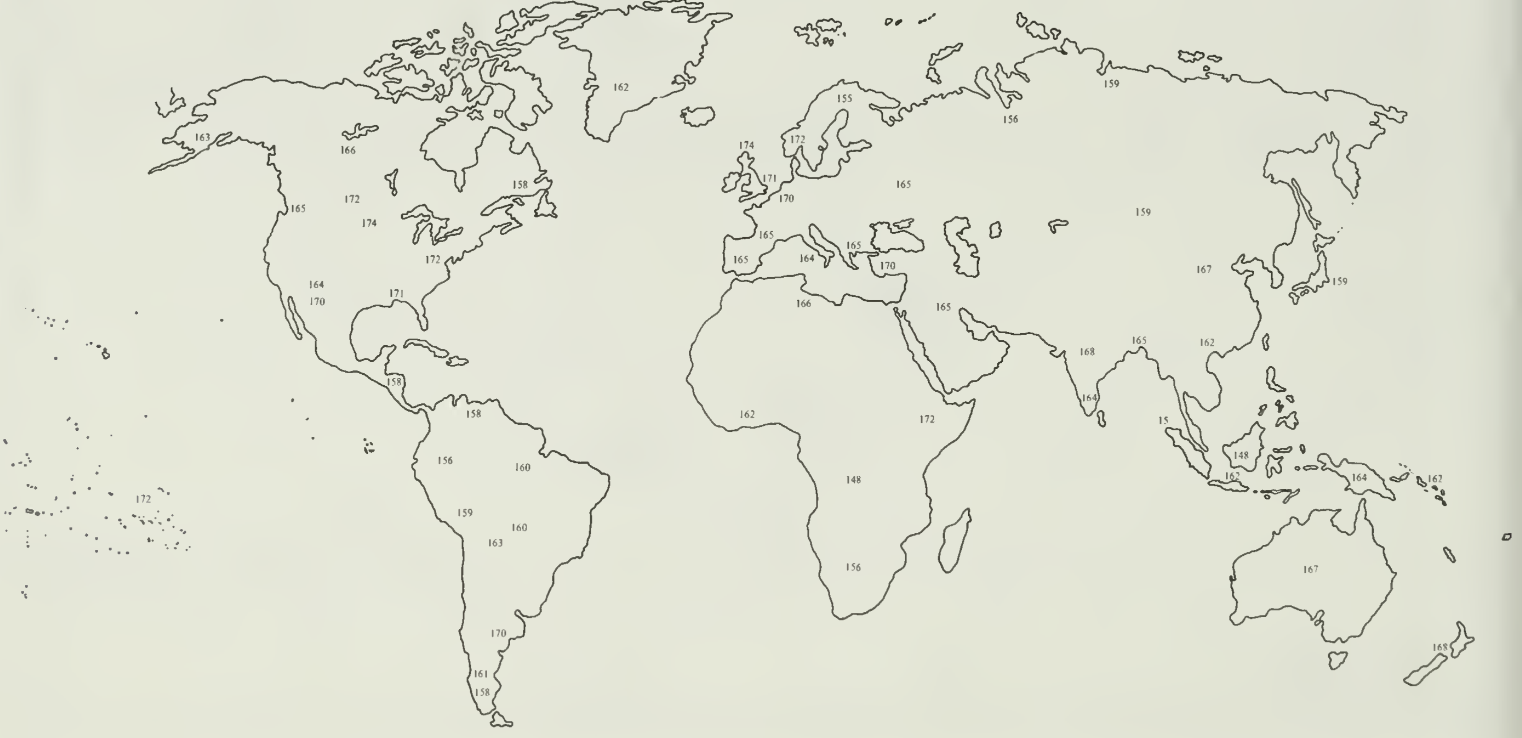
six long bones from Gran Quivira, Pecos, and Point of Pines. Measures of variability about the mean are given for the first two populations, but were not available for Point of Pines. One of these statistics, the coefficient of variation (C.V.), indicates that variability in bone length is similar for females from the two populations, but Gran Quivira male bone lengths show consistently less variation than those from Pecos. In terms of simply mean length, these three populations have very similar values for all long bones.

Stature Estimates

If stature estimates were made only for individuals with all their long bones present, these estimates would naturally correspond to the bone length measurements. However, a single intact long bone from a burial was the minimal requirement to make an estimate. With only one or a few bones present, the estimations might differ from the measurements because different bones vary in degree of reliability in making estimates. For example, the tibia is more reliable than the ulna, but both are weighted the same if used singly in a stature computation.

By examining Figure 85, one can see that the temporal changes in the stature estimates derived from the three formulae closely correspond to changes in long bone length (fig. 84). For each of the formulae the mean stature estimates for males increase from Early to Middle, and then decrease, to approximately the same degree, from Middle to Late. Data derived by the Genovés formulae exhibit change in the same direction, but to a much less accentuated degree than those obtained using either Trotter and Gleser or Pearson. Female estimates based on the three formulae concur both in magnitude and direction of change through time. There is a marked increase from Early to Middle, and essentially no change from Middle to Late.

Lack of metrical data for each individual from Pecos and Point of Pines prohibits the reconstruction of the stature of these groups in a manner analogous to that followed for the Gran Quivira sample. However, a rough approximation of the mean stature of these populations can be obtained if one takes the mean lengths of all the long bones, inserts these into the respective single bone formulae (or table) of Genovés, and then computes the mean of these six stature estimates. When this procedure was followed with data on Gran Quivira, it yielded a mean stature of 162.0 cm. for males and 151.7 cm. for females, values which differ from those derived by the more tedious method (see table 77), by 0.4 cm. and 0.3 cm. respectively. As these two methods give similar results, an adequate estimate of mean stature can be made for the other two populations. For Pecos, the derived estimates are 161.4 cm. for males and 151.2 cm. for females. The Point of Pines populace was only slightly taller, the males being 162.0 cm. and the females 152.8 cm. Sex differences in stature for these three populations are 10.3 cm. (Gran Quivira), 10.2 cm. (Pecos) and 9.8 cm. (Point of Pines), values which approximate the average sex difference of about 12.0 cm. for living Southwest Indians (Hrdlicka, 1908, p. 135).



85. Distribution of male stature throughout the world.

The stature estimates for males from Gran Quivira, Pecos, and Point of Pines are shown in Figure 84 (capital letters), together with male stature means for living Southwest Indian groups. Note that the "rough" mean of 162.0 cm. is used for Gran Quivira males rather than the more accurately derived 162.4 cm. in order to standardize the comparison between the skeletal populations. The three early populations appear to be somewhat shorter than living Puebloans, but this difference is not marked. Since stature estimates are not exact, a secular increase in height cannot be postulated among these groups over the last several hundred years. The contrast in stataure between Puebloans, both skeletal and living, and other Southwest Indians will be the subject of the following discussion.

Discussion

Twin studies indicate that stature is under strong genetic control. H. H. Newman, Freeman, and Holzinger (1937, p. 117) and Clark (1956, p. 50) calculated heritability estimates (h^2) of 0.81 and 0.88 respectively, which suggest that slightly over 80 percent of the variation in stature is due to hereditary factors. Although Kempthorne and Osborne (1961, p. 334) criticized the reliability of h^2, they stated that analysis of data on monozygotic twins "suggests almost perfect genetic determination of height."

Despite the seemingly strong influence of heredity, stature can still be modified by environmental variables. Of these, nutrition probably has the greatest short-term effect. Malhotra (1966, p. 348) proposed that height variation among populations in five Indian regions reflects racial, climatic, and especially nutritional differences. The importance of nutrition is suggested by the positive correlation of stature with protein and caloric intake. At one extreme, Punjab/Delhi males have a mean stature of 168.40 cm., with a protein intake of 91 g. and a caloric intake of 3330 kcal. per day. In the Madras/Kerala region, which has the shortest populace (male stature averaging 163.74 cm.), the corresponding food intake is 53 g. and 2068 kcal. per day. Three other areas have intermediate values for food intake and stature. Takahashi (1966) believed that improved nutrition–attributed to increased calcium in the diet –might explain the height increase of Japanese children following World War II. Ivanovsky (1923) reported that various Russian populations decreased in stature by 3 to 5 cm. during a severe famine, but they regained their previous height when the food supply again became normal.

Variables other than nutrition are of more importance when stature is considered as the result of long-term adaptation. For an overview, a general scheme on the stature distribution of indigenous populations throughout the world is presented in Figure 85. Data for this map were taken largely from Deniker (1903), with large samples selected which seemed to best represent the total mean stature in a geographic region. According to Bean (1928, p. 4), "steppes, pampas and fertile regions in temperate zones produce high statures. Jungle and infertile cold regions produce low statures." He also noted that coastal populations tend to be shorter than populations in the interior.

Bean's observations appear to have more explanatory value than the so-called ecogeographical rules of Bergmann and Allen because he did not restrict them to the variable of latitude. Still, M. T. Newman (1966) has attempted to demonstrate that these rules do apply to indigenous New World populations for a series of anthropometric traits, including stature. Newman (ibid., p. 154), who illustrated the type of clinal variation that would be expected if latitude is related to height adaptation, felt that this distribution resulted largely from adaptive changes after man had reached the New World (ca. 15,000 B.P.).

The Southwest is one area where stature cannot be fully explained in terms of the Bergmann and Allen rules (see fig. 84). In this region, it is not surprising to find that stature corresponds closely to linguistic groupings. In western and central New Mexico, there are the Zuñi, and the Tanoan- and Keresan-speaking Puebloans who are all relatively short. On the other hand, the Yuman linguistic family, focused along the Colorado River, is represented by the tallest populations in the Southwest (Yuma, Mohave, and Maricopa). The Pimans (Pima, Papago, and Yaqui) and Athapaskans (Navajo and Apache) are only slightly shorter than the Yumans.

There are certain exceptions to the above language-height correlations. The Hopi, although physically and culturally aligned with other Puebloans in New Mexico, are linguistically classified in the Uto-Aztecan family, together with the significantly taller Pima, Papago, and Yaqui. Hopi is quite divergent from other branches in this family (Voegelin, 1958), and it is possible that Uto-Aztecan can be linked with Tanoan, a Pueblo language, to form Aztec-Tanoan (Whorf and Trager, 1937). These factors lessen the significance of the distinctness of the Hopi language within the Pueblo culture area. Other notably short groups in the Uto-Aztecan family are the Tarahumara and Tepehuane, the latter closely affiliated linguistically with the Pima and Papago (S. Newman, 1954). Another exception is the Upland Yumans, who in stature resemble the Southern Ute and Paiute (Uto-Aztecans) rather than the River Yumans. Spuhler (1954) found a similar relationship when he computed biological distance estimates based on 14 anthropometric traits, not including stature.

Stature differences in the Southwest could have resulted from local differentiation after populations of similar heights migrated into this region. Another possibility is that populations of dissimilar heights moved into the Southwest and retained their distinctness through time. These are not mutually exclusive possibilities, however, since some populations could have changed, while others remained stable. The problem is to determine their relative consequences.

Of the Yuman, Piman, Puebloan, and Athapaskan populations, only the Athapaskans fail to show the time depth in the Southwest that was probably necessary for local adaptive changes in height to take place. Archeological and ethnohistorical data link the prehistoric Basketmaker and Pueblo with extant Pueblo populations (cf. P. S. Martin and Rinaldo, 1951), and suggest continuity between the Hohokam and/or Ootam and the modern Pimans (Di Peso, 1956; Ezell, 1963; Haury, 1967; Hayden, 1970). Tracing the precursors of these populations back any farther than 2,000 years is difficult, but it is possible that their occupancy in the Southwest can be reckoned in several thousands of years if they descended from the early hunting and gathering groups that inhabited this area–that is, the Desert Culture and Cochise Complex (Haury, 1962). The prehistory of the Yumans is not well documented, but there is general agreement that the Hakataya (Schroeder, 1957) formed the ancestral pool from which the living populations were derived. This tradition has been dated back 1,500 to 2,000 years along the lower stretches of the Colorado River, roughly the time when M. J. Rogers (1945) and Hayden (1970) placed Yuman groups first settling this area. Stratigraphic control is not good because sites are periodically inundated by the river, so the question of greater time depth remains controversial.

The Hohokam and Hakataya generally cremated their dead, a practice that hinders attempts (such as stature reconstruction) to demonstrate biological continuity within, and relationship between, the two traditions. Estimates of biological distance between their purported modern descendants, the Pimans and River Yumans, do suggest some affinity (Spuhler, 1954; Hanna, 1962). Furthermore, both of these groups are characteristically tall (197-175 cm.), contrasting markedly with the short Puebloans (at 164 cm.). Thus, it is possible to follow Kroeber (1939) in comparing the Sonora-Gila-Yuma and the Pueblo sub-cultures in an attempt to discern the variables that might be responsible for the above height differential.

The Puebloans and the Pimans and Yumans inhabit the Upper and Lower Sonoran life zones, respectively. The altitude of the first zone is from 3,500 to 6,000 ft., with vegetation varying from grasses and sagebrush to piñon and juniper. The basin and range province of the Pimans and Yumans is at a lower elevation, which ranges from 100 to 4,000 ft.? creosotebush and paloverde are the predominant biotic communities (Lowe, 1964). The region of the Pimans and Yumans is characterized by a higher mean annual temperature and a lower mean annual precipitation than that of the Puebloans (Hack, 1942; Castetter and Bell, 1951).

Physiographically, these two areas are distinct, but not to the degree one would expect if the environment had played a major role in height adaptation. In fact, the stature of Southwest groups could not be predicted from either Bergmann and Allen rules or Bean's observations; according to these, the taller populations would be found at the higher altitude and more northerly latitude. Allen's rule may help explain the short stature of Eskimos, but it cannot be applied to the Puebloans—Eskimo stature is attributed to their short lower limbs (M. T. Newman, 1966), but the relative sitting height and relative span of Puebloans closely approximate those corresponding data on taller Southwest Indian groups (Gabel, 1949).

As Hrdlička (1909) has previously noted, an examination of the environment does not yield an obvious explanation for the variation in stature among Southwest Indians groups. Such cultural variables as the matrilinear descent system and the pacific temperament of the Puebloans can be viewed against the patrilinear system and warlike nature of groups in the Sonora-Gila-Yuman sub-culture (Kroeber, 1939), but it is difficult to envision their influence on stature. Possibly more important are their contrasting subsistence and settlement patterns.

The development of Pueblo culture was dependent on intensive agriculture, even though the environment of the plateau is poorly suited for farming in regard to availability of water and length of growing season (Hack, 1942). Populations of the Sonora-Gila-Yuma sub-culture, generally found along water courses, practiced canal irrigation (Piman) and river overflow irrigation (Yuman), but probably depended less on agriculture than the Puebloans. Both sub-cultures raised the three native American staples of maize, beans, and squash (Castetter and Bell, 1951; Dozier, 1970). Although the Gila Pima were most reliant (50 to 70 percent) on cultivated crops, it appears that the River Yumans did not fully exploit the agricultural potential of their area, possibly for cultural rather than environmental reasons (Castetter and Bell, 1951, p. 255). Even among the Mohave, who farmed more than other Yuman groups, wild products such as mesquite, screw bean, fish, and rabbits made up a half of the total food supply (ibid., p. 249). Protein and caloric intake may have differed between early desert and plateau populations, but it seems unlikely that this would have been great enough to result in and maintain a height difference of 5 to 10 cm.

The lowland topography of the desert where the Pimans and Yumans settled in villages along rivers contrasts the "isolating, canyonlike character of the Pueblo habitat in which permanent towns grew up" (Kroeber, 1939, p. 38). Such differences in topography and settlement pattern might affect population structure, and hence the level of inbreeding. It appears that Wright's (1969, pp. 290-299) "island" and "stepping stone" models could be applied to Puebloans, whereas the "isolation by distance" models along a linear range (i.e., rivers) and over a uniform area might fit Piman and Yuman population structure. It is only conjectured that these models may relate to the potential interplay between increasing homozygosity through inbreeding and decreasing stature (Schreider, 1967).

When the Spanish arrived in the Southwest over 400 years ago, they not only introduced a number of domesticated plants and animals, but they altered settlement patterns and affected the population size of the indigenes (Spicer, 1962). Any or all of these factors could potentially have led to an increase or decrease in the height of Southwest tribes. However, the estimated stature of prehistoric-historic Eastern Pueblo series from Gran Quivira and Pecos is comparable to that of living Puebloans. Furthermore, the stature of Yuman groups was probably not greatly influenced by the Spanish, because reports by the Melchior Diaz expedition in 1540 made note of their great size (Forbes, 1965). In 1700, Fray Kino said the Yumans "were of very lofty stature, and the principal one of them was of gigantic size and the largest Indian that we had ever seen" (ibid., p. 46).

Although the stature of Puebloans and Yumans was apparently not modified to any great extent following Spanish intrusion, some effect on the Pimans cannot be ruled out. Breternitz and Shutler (in Di Peso 1956, p. 69), using the Pearson formulae to reconstruct the stature of Upper Pimans from San Cayetano, derived means of 161.3 cm. for 15 males and 150.9 cm. for 13 females. Hayden (1970) has recently proposed that the militarily oriented Pima from San Cayetano did form part of that contingent from the east that invaded and *displaced* the Hohokam settled along the Gila River. According to Breternitz and Shutler, if these Upper Pimans are ancestral to the significantly taller living Gila Pima, the most plausible explanation for the 10-cm. height increase is interbreeding between these "short" Pima and the "tall" Papago and Maricopa populations. Since the Pima and Papago are of essentially the same height today, this would have required not only an unusually high rate of admixture, but also hybrid intermediacy complimented by heterosis. Furthermore, no evidence is presented that indicates the Papago necessarily had to be "tall" at that time. Breternitz and Shutler did point out that the introduction of new foodstuffs by the Spanish could have been related to a Piman height increase, but one would then have to explain why this did not also apply to Puebloans. Physical variation within the Piman language branch may partially account for the short stature of the sample from San Cayetano, since the Tepehuane, a Piman group in Mexico, have a mean height of 165.3 cm. for males and 151.6 cm. for females (Hrdlička, 1909).

Summary

Body height is a highly heritable character that can be modified to a degree by non-genetic variables. Stature reconstruction is potentially useful in skeletal biology because, in a skeletal series divided into time periods, temporal variation in height may reflect changes in the genetic composition of the population and/or in the conditions of the environment. Stature estimates offer a major advantage over long bone measurements, in that they provide a basis for comparisons with living populations.

For estimating the stature of Southwest Indian populations, the recently derived formulae and tables of Genovés (1967) are more reliable than the Trotter and Gleser (1952, 1958) or Pearson (1899) formulae. The latter two are most reliable in the sense that the six long bones, when treated singly, give similar stature estimates.

The stature reconstruction of a sample of 89 individuals from the Eastern Pueblo skeletal series of Gran Quivira yielded mean estimates of 162.4 cm. for males and 152.0 cm. for females (Genovés method). A slight increase in stature for both sexes from the Early to the Middle period is suggested, but as Reed (part 7) notes, this may simply reflect the small sample for the Early period. Change in stature through time can probably be considered insignificant at this pueblo, unless other data reflect similar types of phenomenon. Reed also feels that Plains tribes, possibly Apache, could have exerted some influence on the Gran Quivira population "with mounting impact later in the occupation." Although interbreeding between the Puebloans and taller Plains groups could have stimulated some height increase, this would require a fairly high rate of admixture to be clearly reflected in stature. Vivian (1964) suggested that one other intrusive element, the Jornada Mogollon, may have affected the Gran Quivira populace not only as neighbors but as cohabitants. If the stature of the Western Pueblo (Anasazi-Mogollon) population at Point of Pines is at all indicative of the stature of the Jornada group (i.e., 162.0 cm.), it would be very difficult, if at all possible, to separate the Pueblo and Mogollon elements residing at Gran Quivira on the basis of stature.

Inter-populational comparisons between the three Pueblo populations of Gran Quivira (Eastern), Pecos (Eastern), and Point of Pines (Western) indicate these populations were similar in height, that is, about 162 cm. and 152 cm. for males and females, respectively. This would place these groups at the low end of the height range for modern Puebloans.

In the Southwest, Piman and Yuman groups are 5 to 10 cm. taller than Pueblo populations. Variables such as altitude, latitude, subsistence, settlement pattern, and so forth could be indirectly related to this stature distribution, but genetic differences between groups is the most plausible explanation. It could not be determined if this height variation reflects genetic diversity in groups that originally moved into the Southwest, or adaptive differentiation after their arrival. Although it does not seem that Spanish intrusion stimulated a recent change in stature in Puebloans and Yumans, the possibility of some effect on the Pimans cannot be entirely discounted; the estimated height of a skeletal series of Upper Pimans is 10 cm. less than that of their presumed descendants.

11. Mandibular First Premolars

Sheila Coyne

The dentition is a significant tool for anthropological studies. No other part of the human body can be so conveniently studied, using the same techniques, in both the living and in skeletal material. The anatomical structure most commonly preserved after death is the dentition, and, indeed, more fossil primates are known from teeth than from all other bony remains (Lasker, 1951, p. 191). Teeth are also important for genetic investigations. Dental features, despite the fact that they are subject to environmental influences during their development, are governed by the action of genes, although little is known about the exact mechanisms of their inheritance (Kraus and Furr, 1954, p. 554). Moreover, the incidences of the occurrence of dental traits have been found to differ among human populations (Dahlberg, 1945, p. 676). This fact makes dental analyses of great importance in racial and population studies. In addition, because teeth are paired structures, they provide their own twin for studies of genetic control.

Quite a bit of data have been collected on variations in tooth morphology of living and dead populations, as well as some from other primates. Most of this data, however, have been confined to information about the permanent molars and, to a lesser extent, the permanent incisors; very little has been done with the rest of the dentition. The mandibular first premolars have suffered neglect along with the other premolars and the canines. Early anatomical descriptions of the lower first premolars were often cursory, with little attention paid to details and without any attempt at classification (Kraus and Furr, 1954, p. 556). Jackson and Blount (1942, p. 1267) noted the presence of the median ridge uniting the buccal and lingual cusps, and also observed the occlusal pits. The first serious attempt to describe and classify the features of this tooth, however, was made by Kraus and Furr in 1954. They described 17 traits, and observed and recorded the frequencies of these traits in over 800 lower first premolars from several ethnic groups living in southern Arizona.

The present study utilized a skeletal series from Gran Quivira National Monument (Hayes, 1980), which consisted of approximately 200 burials and 80 cremations that spanned 300 years. Because the pueblo extends well back into the prehistoric period and on into the era of the Spanish colonization of New Mexico, the skeletal series is a valuable source of data on possible local micro-evolution, as well as on potential admixture.

Most of the adult dentition in the series has been worn down flat. Even in the 21-to-35 age class there are few individuals with unworn teeth. Moreover, there are only a small number of individuals between the ages of 9 and 21. Therefore, only 19 individuals could be examined for variations in the morphology of the mandibular first premolars. Sixteen of these individuals were represented by both right and left teeth, and three had only the right lower first premolar. The composition of the sample was: Early Phase, one male; Middle Phase, two males, six females two of sex unknown; and Late Phase, one male, six females, and one of sex unknown.

It was decided to use only 7 of the 17 traits originally defined by Kraus and Furr (1954). Of the remaining 10, 7 were found to overlap somewhat; thus, rather than re-define them and perhaps create confusion, they were eliminated altogether. The other three definitions were not of discrete traits, but of subjective descriptions of morphology—that is, the plane of the protoconid ridge, the relative size of the protoconid ridge, and the coronal profile of the tooth—and were therefore rejected. The seven traits utilized are:

1. External lingual grooves
2. Sagittal sulcus
3. Relative position of the deuteroconid (lingual cusp)
4. Number of lingual cusps
5. Central occlusal ridge of the protoconid (buccal cusp)
6. Number of occlusal pits
7. Deuteroconid-protoconid relationship

In addition, the teeth were examined for the presence of an accessory occlusal tubercle; none, however, was found.

Table 78 gives the observed frequencies for the seven traits. The three time periods were lumped together, since no significant differences were found in the frequencies after doing a chi-square test. The greatest chi-square obtained was for external lingual grooves, $X_2^2 = 4.2667, p = 0.20\text{-}0.10$. Only one significant difference was found between males and females; this was for the frequency of occlusal pits, $X_1^2 = 4.0668, p = 0.05\text{-}0.02$. However, it must be remembered that there were only 12 females and four males; a larger sample size might not yield the same results.

Table 79 is an alaysis of symmetry for each of the traits within the 16 individuals with both first mandibular first premolars. No significant differences existed between males and females. There were four females, one male, and one of sex unknown, which were symmetrical for all seven traits.

In addition to the data recorded in Tables 78 and 79, a high correlation between the relationship of the protoconid and deuteroconid with the sagittal sulcus was observed. Using Yule's correlation of association, a value of 0.8863 was obtained. A perfect correlation would yield a value of 1.0. Only one tooth that exhibited an interruped sagittal sulcus did not also show a fused protoconid and deuteroconid, but rather had two lingual cusps separated by an extension of the occlusal protoconid ridge. Each of the four teeth with an uninterrupted sagittal sulcus also had independent protoconids and deuteroconids.

Summary

The lower first premolars of 19 individuals from Gran Quivira National Monument were examined for seven discrete traits. The only trait that differed significantly between males and females was the number of occlusal pits. No significant differences, however, were found between the prehistoric inidividuals and those of the Spanish colonial period. Of the seven traits four exhibited symmetry greater than 80 percent between right and left teeth in the same individual. Finally, a positive correlation was found between two of the features—the sagittal sulcus and the relationship of the deuteroconid to the protoconid.

12. The Outward Appearance of the Average Male Face

R. J. Burch and C. G. Turner II

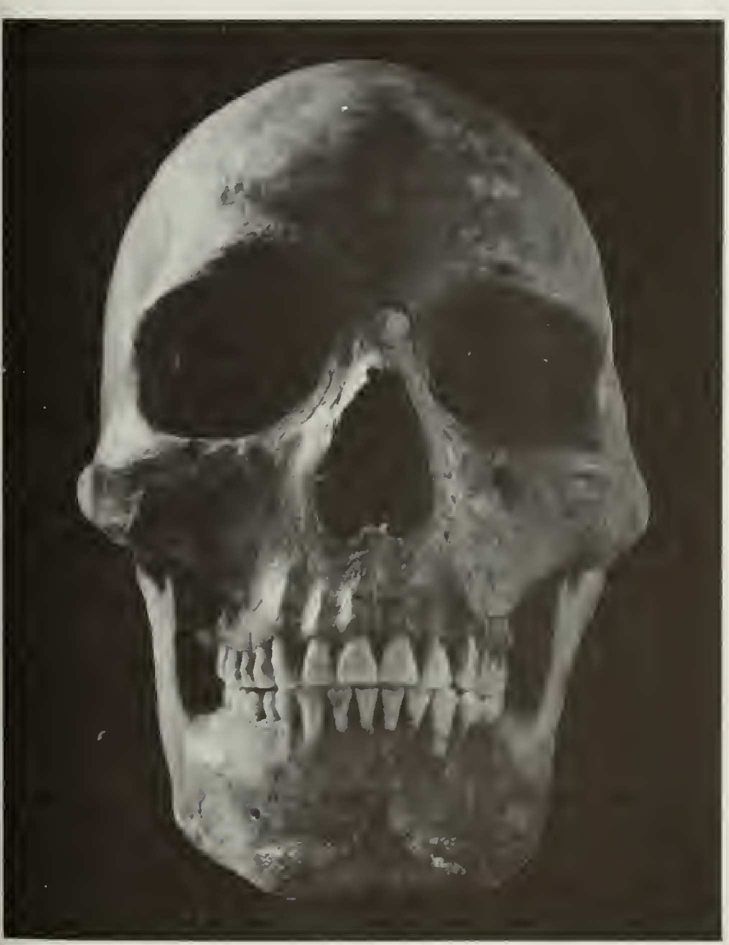
Individually identifiable reconstructions by clay modeling of the external soft-tissue facial form and character depend on two important variables (in addition to skulls whose age, sex, and race are definitely known): precise knowledge of facial soft-tissue thicknesses, and individual character attributes. For our prehistoric Indian reconstruction we are dependent on measures of tissue thickness obtained from White cadavers (Krogman, 1946, 1948, 1962), since none exist, as far as we know, for American Indians. In all, 23 measurements of the face and scalp are available, in terms of both lean and heavy persons. We are aware that the measurements may not, in every instance, reflect the American Indian condition. Other problems occur as well (Suk, 1935; Prinsloo, 1953; Stewart and Trotter, 1954). For instance, the important and character-forming individual attributes arise from such minor details as muscle tone, behavioral acts, skin wrinkling, nose shape, skin texture and hue, and scars. Some of these are under broad genetic control, with expression modifiable by environmental factors such as weathering, handedness, tatooing, head-binding, tooth loss, fighting, disease, worry, and so forth. Still, if a reconstruction avoids attempting to "individualize" and seeks only to represent the *average* young adult, then such genetically controlled quantitative traits as hairline, color of eye, skin, and hair, facial hair and distribution, tooth size, bone shape, and eye-fold (which in American Indians are not excessively variable) lend substantial credibility to the final representation.

Procedure

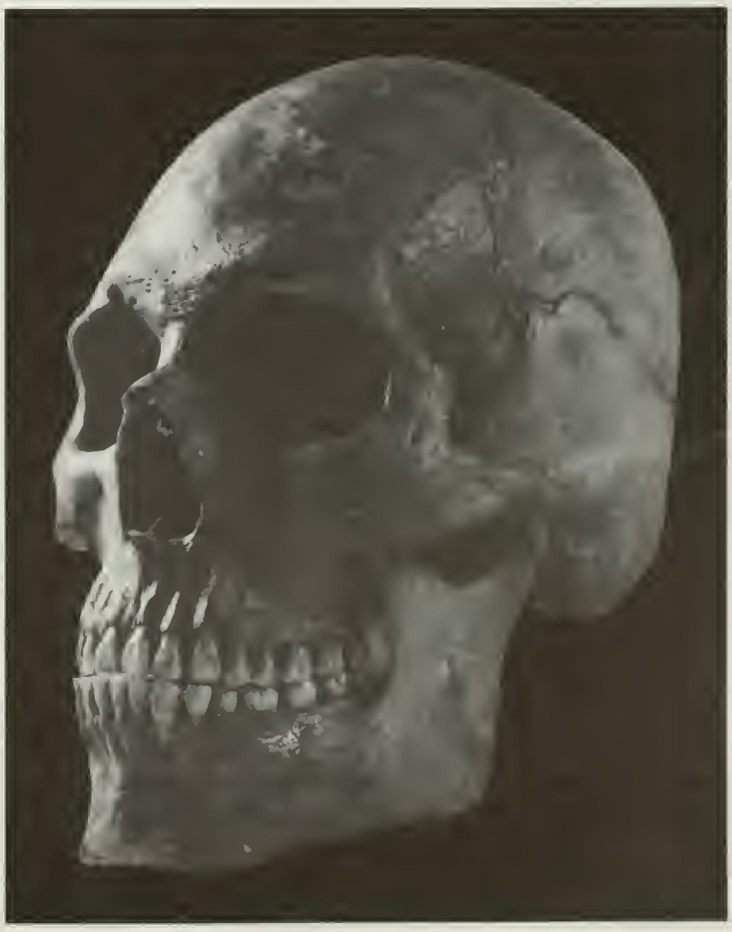
Step 1. From a total of 58 maeasurements taken by E. K. Reed (Part 7), we chose 27 to represent the average young adult male of Gran Quivira. We selected the single undamaged cranium and mandible that came the closest to all 27 mean values for the pooled skeletal series (figs. 86 and 87).

Step 2. Using a rubber molding compound (Pliaflex), cotton gauze, and cotton, we built up a multi-layered negative rubber impression of the original skull and jaw. After curing at room temperature for several days, the mold was cut in the posterior midline to remove the unharmed original.

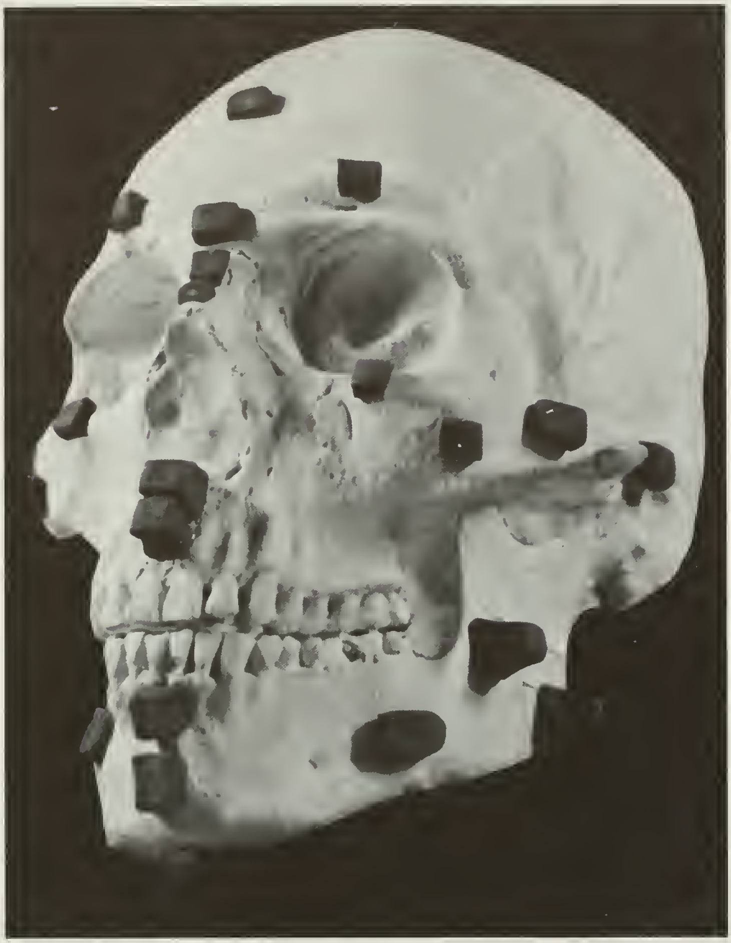
Step 3. Using regular casting palster, we obtained a duplicate of the original skull by pouring liquid plaster into the mold.



86. The average male skull, frontal view.



87. The average male skull, side view.



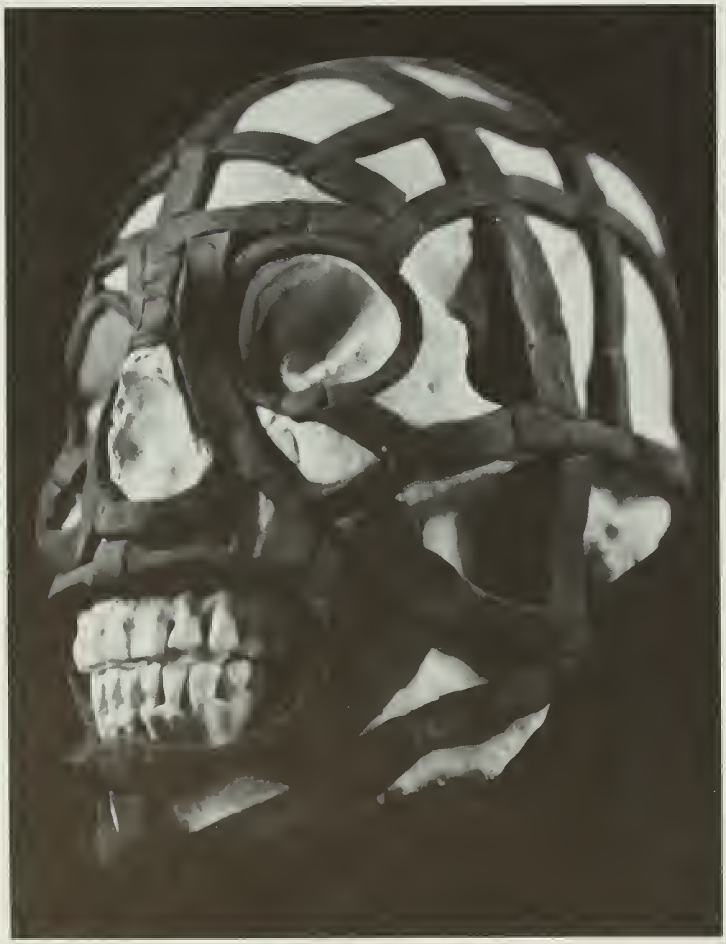
88. Plaster replica of skull shown in Figures 86 and 87.

The dry and hardened plaster "positive" was checked for dimensional accuracy, and painted with floor wax to seal it for the modeling base. Steps 2 and 3 were necessary, since modeling directly onto bone leaves it stained, greasy, and destructive to the tiny bones—as we learned from preliminary experiments with the entire procedure.

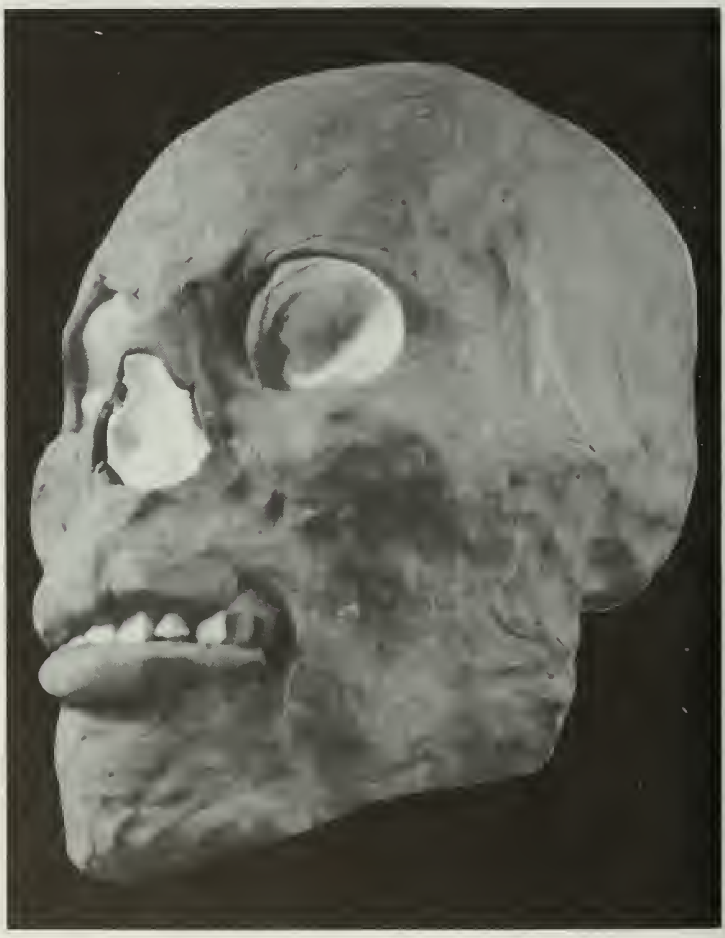
Step 4. Plastaline brand modeling clay, cut into small measured cubes, was placed at the points derived from published cadaver studies (fig. 88). These soft-tissue depth indicators were then connected by a matrix of clay strips of varying thickness (fig. 89). A final filling in of the strips was smoothed and modeled (fig. 90). Altogether, about 30 pounds of clay were used for the completed bust. Skin color was matched beforehand by mixing oven-melted clay yellow ochre, burnt umber, moss green, and royal blue oil-base pigments. We tried to follow published American Indian skin color charts, but found them subjectively too light. The final tone was matched against the facial coloring and intensity of a part-Indian anthropology student. Modeling had been developed earlier on test lab material.

Step 5. Final details included the placement of the glass eyes, the molding of the eyelids, nose, and mouth, and the wig placement (figs. 91 and 92). These were all more subjective than the other steps.

The final reconstruction met our minimal expectations in that it did, indeed, look like an American Indian. However, it exhibits a rather mixed Pueblo and Plains Indian appearance. This we think is due more to the problem of modeling the nose (for which there is almost no bony guidelines) than to the facial configuration as a whole. In addition, the face is lean-appearing, which is not in



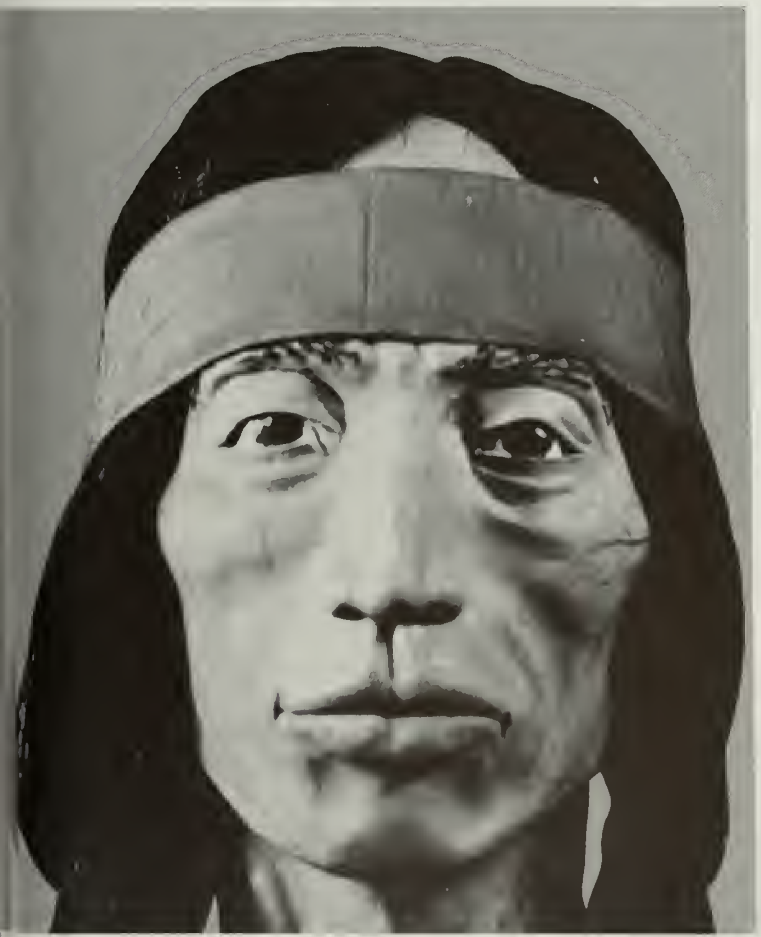
89. Plaster replica with connecting clay strips in place.



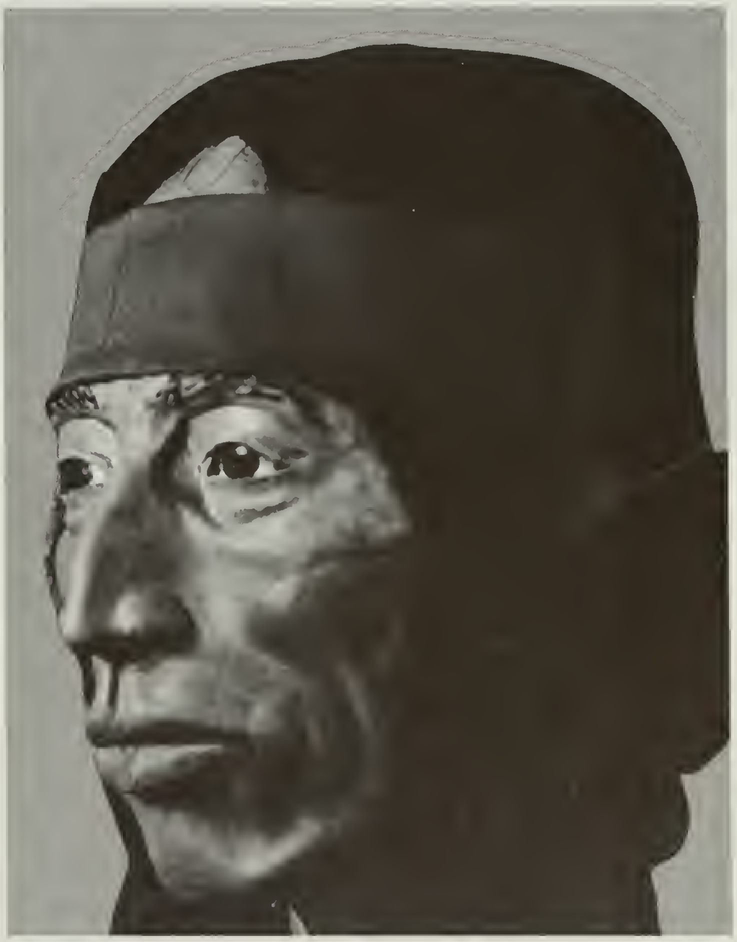
90. The basic reconstruction with strip matrix filled and smoothed out.

character with Pueblo Indians, whose carbohydrate-rich maize diet causes even young adult body and facial fat padding. This softens the facial features. We also had trouble positioning the eyes. Possibly a bit of skin wrinkling might have given the reconstruction the more weathered look associated with the more commonly seen older Pueblo Indian man. However, as best as we can judge, the reconstruction reflects the outer appearance of the *average prehistoric young adult Gran Quivira male*, whose true likeness we can never know. Since our primary guideline was the bony skull itself, and since skull form and size do differ significantly between geographic and local races, we offer our reconstruction as the best available for a look back into the past at a prehistoric Gran Quiviran face.

And in that whimsical vein, it might be valuable to conclude with the reminder that this glimpse of the past is a privileged one, based, as it is, on the actual remains of a once-living person. As we go about our detached scientific use of human skeletal remains, we should never lose sight of the fact that we are handling the bits of once happy, troubled, or satisfied men, women, and children, all of whose brief puff of activity on the continuous chain of life had far more significance that the residual dusty bones and teeth will ever reveal.



91. Frontal view of the completed reconstruction.



92. Side view of the completed reconstruction.

13. Tympanic Plate Dehiscences in Crania

Christy G. Turner II and Joseph Katich

The presence of a dehiscence in the osseous floor of the temporal bone's tympanic portion is due to incomplete growth of bone from post-natal secondary ossification centers of the primary annulus. Cross-sectional investigations have shown that from these three secondary centers arise both the bony tympanic plate and the bone forming the distinctive shape of the auditory meatus margin (Turner and Laughlin, 1963). The dehiscence-frequency similarities within related groups, and differences in frequency between nonrelated groups, plus within and between group growth regularity suggest that dehiscence has a genetic basis and is not due entirely to such non-genetic factors as malnutrition, infection, or similar developmental stresses. However, the position of the small (0.1 to 6.0 mm. in diameter) dehiscence in the floor of the tympanic plate immediately lateral to the delicate ear drum is such that it cannot be safely or inexpensively studied in the living, therefore preventing family studies on its mode of inheritance. This being the case, there is no value to testing inheritance models by population genetics means, since these are not decisive, depending in the end on family methods. Thus, the dehiscence is best studied cross-sectionally in skeletal material. This means that estimates of its adaptive value, as well as inheritance and developmental function, if any, will not be immediately forthcoming.

The results of our brief analysis on the Gran Quivira skeletal remains (already discussed in previous parts of this volume) are:

1. Occurrence of the dehiscence in 20-year and older crania shows no statistically significant sex difference ($X_1^2 = 0.14$; $p > 0.5$), that is, it occurs similarly among our sample's 28 adult male (32.1 percent) and 26 adult female (38.5 percent) skulls.

2. All Gran Quivira infant temporal bones possess normally bilateral, large dehiscences. These gradually grow smaller and disappear with the completion of the floor around age 12, if floor completion was pre-determined. After age 12 the dehiscence frequency remains stable—more so than among the Sadlermiut Eskimo, whose dehiscence frequency continues to decrease from 55 percent at 18 years to 25 percent at a maximum age of about 50 years (Turner and Laughlin, 1963, p. 406) Between birth and age 12 the frequency decreases.

3. The total Gran Quivira dehiscence frequency (all time periods, both sexes plus sex indeterminable) is 33.3 percent (21/63). This is greater, but not significantly so, than that of prehistoric Pecos Indians (male, 16.2 percent; female 24.3 percent; male and females, 21.5 percent) studied by Hooton (1930, p. 107). It is less than that of prehistoric-historic Hopi Indians (44.0 percent) and that of 30 similarly aged, probably Hopi crania (46.5 percent) from a mass Hopi grave studied by Turner and Morris (1970, p. 329); these are also not significantly different in dehiscence frequency from that of Gran Quivira crania. But, importantly, the Gran Quivira value is between those of Hopi to the west and Pecos to the northeast, like the geographical positions of these three skeletal series.

The Gran Quivira frequency of 33.3 percent is slightly more than half that of a prehistoric sample of 64 Pachacamac and 111 Chincha crania from Peru, which pooled is 62.3 percent (sex and between-group frequencies of this Lowie Museum [Berkeley, California] series were not significantly different in dehiscence frequency [McKim, 1966]). The occurrence of a tympanic plate dehiscence appears to be characteristic of American Indian crania.

4. Biological variation through time at Gran Quivira can be seen in the unidirectional change of the dehiscence frequency, although it, too, lacks significance at the 0.05 level:

Late Phase	37.0%	(10/27)
Middle Phase	34.6%	(9/26)
Early Phase	20.0%	(2/10)

Hooton (1930, p. 107) found the Pecos dehiscence frequency in both sexes to increase from early Black-on-white Period I to late Period Glazes V and VI, the exact reverse of that above, although not as markedly so.

5. Side symmetry and the size relationship of the dehiscence is regular and high in Gran Quivira. The correlation coefficient (r) for size and side occurrence ($n = 43$) is 0.91. As with the other analyses presented here, plate floor pinholes were not considered as expressions of the dehiscence unless they were multiple and positioned at the regular site of this moderately frequent growth characteristic of Pueblo Indian crania.

14. Non-metric Oral Traits in Skeletons

Kenneth R. McWilliams

During the first two of three occupation periods at Gran Quivira, the dead were interred, but in the Late period cremation became an alternate means of disposal. This study attempts to determine micro-evolutionary changes in the three periods, and then to evaluate the biological relationship of the cremated bodies to the Late period interments.

Material and Method

There are 236 skeletons in the Gran Quivira collection housed at Arizona State University. The Early Phase of occupation of the pueblo is represented by the skeletons of 30 individuals, the Middle Phase by 65 skeletons, and the Late Phase by 122 burials, of which 33 are cremations. The remaining 19 skeletons could not be assigned to a time period.

The span of approximately 350 years covered by this skeletal series equals about 17 generations, allowing 20 years per generation, or roughly 5 generations in each period.

The Gran Quivira skeletons were examined to determine the frequency of occurrence of five oral traits: mandibular and palatine torus, three-rooted permanent mandibular first molars, and multi-rooted permanent maxillary first and second premolars. These traits were chosen for study since Merbs (1967) showed that they are likely to be scorable in cremated material.

The traits were scored simply as present or absent. A mandibular torus was counted present if there was any manifestation of irregularity, visible or palpable, at the otherwise smooth locus of the trait. A palatine torus was counted present if there was any degree of ridging along the inter-maxillary suture. "Supernumerary" roots were counted present if a bifurcation extended more than half the length of the root.

The percentage of each trait was calculated by dividing the number of adult (older than age 18) skulls in which the trait was observed by the number of skulls examined. Symmetry was not considered. Twenty-two skeletons belonging to either of two periods were assigned to the earlier of the two.

Literature

Palatine torus is a benign exostosis occurring along the lingual surface of the intermaxillary suture. Mandibular torus, also a benign exostosis, is located on the lingual surface of the mandible above the mylo-hyoid line, usually in the region of the canine and premolar roots.

Hooten (1930) and Hrdlička (1940), who noted the presence of these exostoses in Southwestern and arctic skeletons, attributed their occurrence to the marked masticatory stress implied by the extreme attrition of the occlusal surfaces of the teeth in these groups. More recent studies, however, have demonstrated the heritable nature of the traits. Moorrees (1957) noted the mandibular torus to be less frequent in Aleut females, to have more marked expression in males, to have no association with tooth wear, to have different frequencies in Eastern and Western Aleuts, and to be present in children—all of which suggest genetic influence. According to Osborne (Moorrees, Osborne, and Wilde, 1952), the trait is influenced by a major gene and two modifiers. Lasker (1950) suggested either autosomal or sex-linked dominant inheritance for palatine torus, and an autosomal dominant with high penetrance to explain mandibular torus. Vidič (1966) also saw a sex-linked dominant manifestation in Yugoslav maxillae. Using pedigree studies, Suzuki and Sakai (1960) determined that both tori were partly governed by a single dominant gene. Johnson, Gorlin, and Anderson (1965) concluded from their own pedigree studies, and those of Suzuki and Sakai, that both tori were determined by an autosomal dominant with incomplete penetrance in males, or by multiple undetected genetic factors. To date, no conclusive explanation has been proposed that would fit all known data.

Reflecting the relatively recent interest in human dental traits, as well as the paucity of workers in the field, the literature on human root-number variation is scant. Nelson (1938) has given molar and premolar root-number data for the Pecos skeletal collection. Similar data was provided by Pedersen (1949) for East Greenland Eskimo skeletons and by Barnes (1969) for living East-African Teso. Turner (1971) presented data on the incidence of three-rooted mandibular first permanent molars in several Southwestern American Indian, Aleut, and Eskimo skeletal series.

Kovacs (1964), using twin studies, demonstrated a hereditary component in root number and morphology. According to Tratman (1950) multiple roots in maxillary first premolars are rare, and even more uncommon in second premolars, and the single-rooted form is more common in Mongoloids than Whites. Lasker and Lee (1957) found two-rooted premolars more common in Bantu than other African groups studied. Turner (1971) concluded that three-rooted mandibular first molars characteristic of Asian and Asian-derived peoples, reaching peak frequency in Aleut-Eskimos. He has shown that a sex-linked recessive mode of inheritance for the trait fits Aleut-Eskimo data, but no other group fits the model. No mode of inheritance has been proposed for multirooted maxillary premolars.

Data

Among the interments a three-rooted mandibular first molar (3RM1) was found in 4 of the 70 mandibles that could be examined for the trait, or 5.7 percent (table 80). There was no predilection for sex or time period apparent in the small sample. Of the seven mandibles in which the trait was observable in the cremations, none showed a 3RM1.

Two-rooted first and second maxillary premolars (2RPM1, 2) both occurred with a frequency of 1.89 percent (1/53). Both double-rooted premolars were found in females, one (2RPM1) in a Late period skeleton, and one (2RPM2) from the Middle period. A 25 percent frequency of 2RPM1 (1/4) was found in the cremated material, but no example of 2RPM2 was found (0/4).

A palatine torus was found in 58.6 percent (68/116) of the Gran Quivira interments of all ages and sexes. In no case, however, was the trait observable among the cremations. The frequency of palatine torus in the Gran Quivira adult males (older than age 21), for all periods combined, was 75.0 percent (24/32), and 55.0 percent (22/40) for adult females (see table 81). Of those under 18 years of age, 50.0 percent (20/40) manifested palatine torus.

A mandibular torus was found in 72.4 percent (113/156) of individuals of all ages among the Gran Quivira interments, while the incidence of the trait among adult interments was 80.7 percent (92/114), and that among the cremations, all adult, was 83.3 percent (15/18). The same frequency was obtained for adult male interments (83.3 percent 35/42). Mandibular torus occurred in 78.8 percent (41/52) of the adult females, and 33.3 percent (21/63) of the sub-adults.

Analysis

Because of the low frequency of 3RM1 at Gran Quivira, no statistical comparisons could be made between the sexes or the time periods.

Turner (1971) suggested a sex-linked recessive mode of inheritance of 3RM1 in Aleut-Eskimos, but noted that this model did not fit American Indian groups. The slightly higher frequency for males (8.0 percent) than females (3.1 percent) at Gran Quivira could indicate sex-linked inheritance, but the sample size of individuals of known sex exhibiting 3RM1 ($N=3$) was too small to permit such a conclusion.

Based on his data Turner saw two American Indian groups, separable by the incidence of 3RM1 in the populations, currently occupying the Southwest. He identified these two groups as the descendants of the original migrants to the Southwest and the later Athapascan-speaking Navajo. Data modified from Table 2 of Turner's paper shows a mean incidence of 3RM1 of 27.3 percent (9/33) for the Navajo, and 5.4 percent (92/1711) for non-Athapascan Southwestern Indians. The frequency of 5.7 percent at Gran Quivira places that population in the original Southwestern group, as expected. It also serves as a slight confirmation of Turner's conclusions. However, Nelson (1938) found no 3RM1 in the Pecos Pueblo skeletons (0/72 teeth).

Quantitative data for the incidence of multi-rooted maxillary premolars is very limited. Tratman (1950) and Pedersen (1949) indicated that two roots are rare in the PM1, and rarer in PM2. Pedersen reported an incidence of 5.05 percent (5/99) for 2RPM1, and 1.03 percent (1/97) for 2RPM2 in East Greenland Eskimos. Nelson (1938) gave the percentage of 2RPM1 at Pecos Pueblo as 11.36 (15/132), and for 2RPM2 as 0.76 (3/171). Shaw (1921) noted that two- and three-rooted forms of the premolars were more common in Africa than elsewhere, and Barnes (1969) found an incidence of 73.9 percent (17/23) for 2RPM1, and 13.6 percent (3/22) for 2RPM2 among the Teso, a Nilo-Hamite tribe of East Africa.

All of the above percentages are based on the number of isolated teeth observed rather than on the number of skulls. This would tend to lower the frequency compared with a skull count if asymmetry is present. On the other hand Pedersen (1949) reported that he counted roots as double if they were bifurcated for at least one-third of their length. Neither Barnes nor Nelson defined their criteria, but they may be less stringent than those used in this study, which would have the effect of increasing the frequencies given in the other reports.

It is apparent that the PM1 root number is more variable than that of the PM2 in every group studied, except Gran Quivira. However, for a trait with the low incidence evidenced at Gran Quivira, the sample size was not adequate to allow inferences to be drawn.

Woo (1950) observed that palatine torus is present prenatally, increasing in size to age 20, "when it ceases to grow, in accord with other body structures, and does not increase in age." The torus was seen in Gran Quivira sub-adults from birth. The frequency in the x-to-3-year age group of interments was 41.2 percent (7/17). Chi-square tests indicated no significant difference between adults and sub-adults within any time period, or for all time periods combined ($p>0.05$).

Woo (1950) and Lasker (1950) concluded that palatine torus is more common in females, while Hrdlička (1940) saw it more frequently in males. Akabori (1939a), Snow (1948), and Hooten (1920, 1930) found no significant sexual dimorphism in the expression of the torus. While this study shows no statistically significant difference between the sexes ($p>0.05$), the trait is seen more frequently in males. Palatine torus was seen in 75 percent (24/32) of adult males, and only 55 percent (22/40) of the adult females).

Lasker (1950) suggested either an autosomal or sex-linked dominant inheritance for this trait, and Suzuki and Sakai (1960) believed the trait to be at least partly explained by an autosomal dominant. While the preponderance of occurrence of palatine torus in females in the studies of Woo (1950) and Lasker suggest a sex-linked dominant inheritance, the higher expression in males in Hrdlička's (1940) data and in this study suggest a sex-linked recessive. Data in Table 82 indicate the sex-linked expression of the torus to vary from one population to another. These results suggest an apistatic effect and indicate that at least two loci are involved. Palatine torus could not be scored in any of the cremations from Gran Quivira.

A chi-square test indicated the difference in incidence in mandibular torus between adults and sub-adults to be significant ($p>0.001$), suggesting an age component in the expression of the trait. Akabori (1939a) not only found similar results among the Japanese, but also that the frequency of mandibular torus is higher among females. Johnson, Gorlin, and Anderson (1965) observed the frequency in American males also to be only 70 percent of that in females. The data in Table 82, however, show a generally higher prevalence of the trait in males in the four American Indian populations studied, as well as in the arctic groups, although chi-square tests showed no significant sex difference in any of the groups at the 0.05 level. In the Gran Quivira series, no significant differences at the same level were found between the sexes within each time period, or for the sexes pooled. Intra-period chi-square tests for each sex showed no difference, except for Early versus Middle Phase males ($p>0.01$). This could reflect sample error ($N=20$), or the hypothetical arrival of the Mogollon at Gran Quivira at the beginning of the Middle period. That errors occurred in the sampling seems more reasonable in view of the unlikely percentage of mandibular torus in Middle Phase males (100.0 percent).

No significant difference was found between Late Phase interments and cremations in the frequency of mandibular torus ($p>0.5$).

The high incidence of both tori at Gran Quivira compared with most of the sites in Table 82 may reflect reality, or it may represent a difference between various observer's view of a torus. According to Witkop and Barros (1963), in case of palatine torus "small parallel ridges separated by a furrow in the mid-line were not recorded." Since this degree of manifestation comprised the majority of palatine tori seen in Gran Quivira skeletons, Witkop and Barros' data could not be utilized for comparison with the Gran Quivira material. Most authors have not defined their criteria for judging the presence of tori, however, and the lack of standardization in the observations no doubt affects the results of one report relative to another.

Conclusions

Analysis of five oral traits in more than 200 skeletons from Gran Quivira gave the following conclusions. First, premolar root number proved to be a poor trait for inter- or intra-group comparisons of the Gran Quivira skeletons. Due to its low frequency in the population, no statistical tests were possible. Second, the frequency of three-rooted mandibular first molars indicated that the Gran Quivirans belonged among the early migrants to the Southwest rather than with the Navajo. This result was not unexpected, but it added confirmation to Turner's suggestion of the utility of the trait for separating Athapascans from other Southwestern Indians. Finally, there was no statistical evidence for differences in the Gran Quivira population in the three time periods during which the site was occupied, nor for separating the cremated population from the interments.

15. Variations and Pathologies in the Vertebral Columns of Gran Quivira Indians

Sheila Coyne

After the skull, the vertebral column is perhaps the best studied area of the human skeleton. It has been examined for congenital defects, the effects of disease, normal morphological variation, age and racial differences, and even phylogenetic relationships (Willis, 1929).

The purpose of this study is the analysis of variations and pathologies in the vertebral columns of 87 adults and 24 juveniles from the Pueblo de las Humanas (table 83). Because of its position in time—extending from the prehistoric period into the era of the Spanish colonization of New Mexico—this skeletal series is an important one.

Only 38 individuals were represented by complete vertebral columns. To increase the sample size, incomplete vertebral columns were utilized, but to ensure statistical accuracy, the traits were analyzed for each vertebra, instead of for the total number of individuals in the sample. Fragmented vertebrae were counted only if at least one trait was observable. If a trait was not observable on a particular vertebra, this fact was noted, and the vertebra was not counted in the statistical analysis for that trait. In the cases of incomplete vertebral columns, it was not always possible to positively assign a number to each vertebra; however, although every effort was made to be as accurate as possible, unfortunately errors were probably made.

Only discrete traits were utilized, with no attempt being made to collect metrical data. For the occurrence of osteoarthritis and osteophytosis, a scale of 0 to 3 was employed for comparative purposes (table 84). All other traits and pathologies were noted only as either present or absent.

Number of Units

According to Willis (1929, p. 163), variations in the number of pre-sacral vertebrae are due to a progressive shortening of the vertebral column; his own data, however, do not seem to support this theory. Of 1,471 skeletons from the Museum of Case-Western Reserve University Medical School, Willis found 1.5 percent with 23 pre-sacrals, whereas 4.1 percent had 25. Other researchers as well have found an increase in the number of pre-sacral vertebrae as often as—and sometimes even more often than—a decreasing number (table 85).

In the present study, of 38 complete columns one had 23 pre-sacrals (2.63 percent) and one had 25 (2.63 percent). The column represented by 23 pre-sacrals was lacking a thoracic vertebra, rather than a lumbar. In the case of the individual with 25 pre-sacrals, the extra unit was a lumbar.

In addition, four individuals were found to have transitional vertebrae. There were three cases (7.88 percent) of the first sacral being lumbarized on the left side, and one case (2.63 percent) in which the fifth lumbar was sacralized on the left. It is interesting to note that all of these unilateral variations occurred on the left side only.

Finally, one vertebral column had six cervicals and 13 thoracics. The right first rib was bifid and articulated with both the seventh and eighth vertebrae. Unfortunately, the left first rib had been lost.

A Bony Bridge on the First Cervical

In 1955, Selby, Garn, and Kanareff reported on the occurrence of a bony spicule arising from the posterior border of the superior articular process of the first cervical arching backward over the *sulcus arteriae vertebralis.* In addition to this bridge, another was found on the first cervical of individuals from Gran Quivira. This bridge also arose from the superior articular process, but in this case it arched laterally over the foramen transversarium (fig. 93). Three first cervicals (6.12 percent) had a complete lateral bridge on one side, and one (2.05 percent) had a complete posterior bridge. The three with lateral bridges also had incomplete posterior bridges.

The occurrence of these two bridges on the first cervical were not an original part of this study, but were only noted in observing double cervical *foramina transversarium.* Therefore, lesser expressions of these features (i.e., incomplete bridges) would likely have been overlooked had they occurred.

Double Cervical Foramina Transversarium

The *foramen transversarium* of the cervical vertebrae transmits an artery with its accompanying veins, as well as a sympathetic plexus from the lower cervical ganglion. The foramina are subdivided in the fifth and sixth vertebrae with the posterior part being for a vein. The third, fourth, and seventh may also be subdivided, or there may be just a bony spicule.

Pietrusewsky (1969), in a study of Tongans, never found double foramina on the first four cervicals. The frequencies for the lower three cervical vertebrae were: C-5, male 5.0 percent and female 9.1 percent; C-6, male 23.5 percent and female 45.5 percent; and C-7, male 0.0 percent and female 20.0 percent. Not only are the frequencies for double cervical *foramina transversarium* greater among the series from Gran Quivira than that from Tonga, but

93. Posterior bridge of the atlas, left side.

more vertebrae were affected—all but the second cervical of the females and the second and third vertebrae of the males showed at least one double foramen (table 86). As Pietrusewsky found for the Tongans, the frequencies for Gran Quiviran females were greater than those for males, although no statistical difference could be demonstrated ($X_1^2 = 1.6296$, $p = 0.30 - 0.20$). In comparing juveniles and adults, the juveniles exhibited lower frequencies than the adults, but again there was no significant statistical difference ($X_1^2 = 3.211$, $p = 0.10 - 0.05$). Comparisons between time periods reveal no differences for males ($X_1^2 = 0.5352$, $p = 0.80 - 0.70$); the differences between the females of the three periods are greater, but still not quite significant ($X_1^2 = 5.8641$, $p = 0.10 - 0.05$) at the 0.05 level of confidence.

Spina Bifida

Cervical Region

The processes of the second through sixth cervical vertebrae are most commonly bifid, while C-1 and C-7 are almost never bifid. Data on this trait have been collected from six populations (table 87). Moreover, frequencies of bifid spines for C-2 through C-6 vary from 100 percent among Europeans to 0 percent for Bushmen. Several authors have noted that bifid cervical spinous processes are both more pronounced and more frequent among Europeans than among other races (Post, 1966, p. 344). Despite the wide range of variation, C-2 and C-5 are most commonly bifid.

For this study a bifid spine was defined as one with a dorsal groove deeper than 1 mm. The Indians of Gran Quivira exhibited the highest frequency of bifidity on C-2, but overall the frequencies were less than those for Europeans. Males and females do not differ significantly, and there are no differences among the time periods. Only one bifid C-1 and C-7 were encountered. These both occurred in the same individual, an adolescent of unknown sex from the Late Phase (fig. 94). This same individual also had spina bifida of the first sacral vertebra.

Thoracic Region

Spina bifida of the thoracic vertebrae has been reported for several populations (Allbrook, 1955, p. 496; Merbs and Wilson, 1960, p. 158). However, no cases of this defect were observed in the Gran Quiviran series.

Lumbar Region

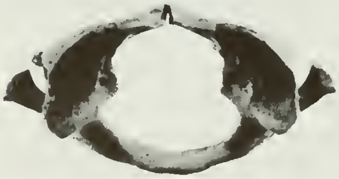
Stewart (1932) found 8 cases of spina bifida of L-5 in 217 Eskimo columns, while Willis (1929) observed it in 1.2 percent of his series of 1,471 columns in the Museum of Case-Western Reserve University Medical School. Two incidences (3.4 percent) of bifid fifth lumbars were observed in the series from Gran Quivira, with both individuals exhibiting other anomalies as well. The first case was in a young adult (age 21 to 35) female of the Late period who also had a completely open sacral canal. The other individual was an old adult (56 to 75 years) male of the Middle period who was also affected with unilateral spondylolysis of L-5. The lower right side of the arch of this male was absent, and there was no evidence that it had ever been joined with either the left side of the arch or with the body and right upper half of the arch.

Sacral Region

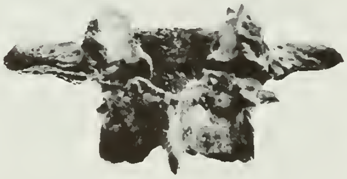
Of 58 complete sacrums of adults and juveniles, there was only one individual with an open sacral canal—the female mentioned above with a bifid L-5. Most of the sacrums of the adults were closed down to the junction of S-4 and S-5. The incidence of an open inferior sacral canal was greater in juveniles than for adults (table 88), a finding that concurs with those of Merbs and Wilson (1960, p. 157) for Sadlermiut Eskimos. There were no significant differences between males and females or between time periods.

Spondylolysis

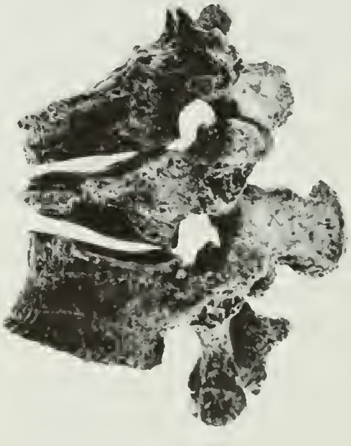
Spondylolysis, spondyloschisis, or separate neural arch is defined as the separation of the inferior articular facets, laminae, and spinous process from the rest of the vertebra. The condition may be bilateral or unilateral, but the bilateral state is by far the most frequently encountered (Roche and Rowe, 1952, p. 491). It occurs more frequently in males than in females (Merbs and Wilson, 1960, p. 159), with the most common site being L-5, although other lumbar, and even thoracic and cervical vertebrae affected by spondylolysis have been reported (Allbrook, 1955, p. 496). The etiology of spondylolysis is not known, but evidence indicates that it is probably a congenital defect, resulting from a lack of fusion through the *pars interarticularis*, rather than being due to a fracture (Merbs and Wilson, 1960, p. 159; Willis, 1929, p. 166).



94. Spina bifida of the atlas, and incomplete *foramen transversarium*.



95. Spondylolysis.



96. Compression fractures of L-1 and L-2.

Spondylolysis in Gran Quivirans was observed only in L-5 (see fig. 95). Three males (16.6 percent) and two females (5.0 percent) were affected. Of the five cases one was unilateral on the right side, while the others were bilateral. As L-5 was the only vertebra observed with spondylolysis, no individual had more than a single vertebra affected. The incidence of this condition among Gran Quivirans is greater than for American Whites (males 6.4 percent and female 2.3 percent) and Negroes (male 2.8 percent and female 1.15 percent) (Roche and Rowe, 1952, p. 491), but less than that among Alaskan Eskimos (20.7 percent) (Stewart, 1932, p. 131) and Sadlermiut Eskimos (male 32.1 percent and female 15.2 percent) (Merbs and Wilson, 1960, p. 160).

The individual with unilateral separate neural arch also suffered from spina bifida of L-5. In the four cases of bilateral occurrence of the defect, only one of the separate arches was available for observation, and it was not bifid. No other defects were seen in the columns of these five individuals.

Compression Fractures

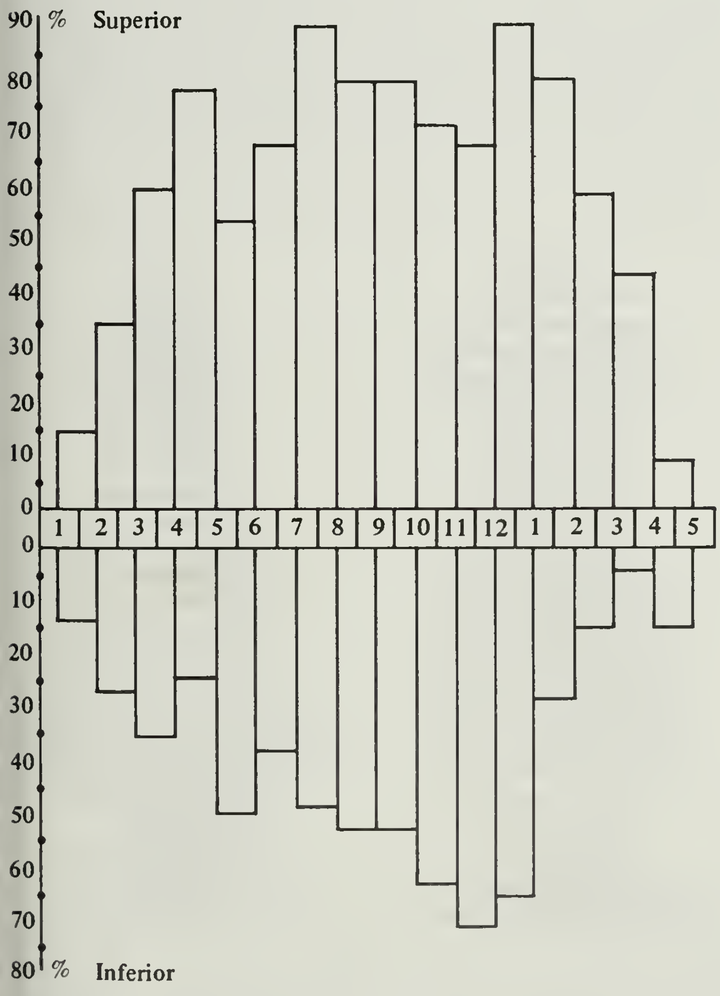
The most common fractures of the thoracic and lumbar vertebrae are of the compression variety, due to severe hyperflexion injuries during accidents (Epstein, 1955, p. 332). Compression fractures are confined to adults, and osteoporosis is frequently associated (Burgess and Romano, 1958, p. 22). While a single vertebra may be affected, more commonly the compression involves two or three segments (Epstein, 1955, p. 336). The most frequent site of compression fractures is the thoracolumbar junction (Ellis, 1944, p. 144). The typical picture presented by a fractured vertebra is that of a wedge-shaped body, in which the anterior height is less than the posterior (see fig. 96). In general, it is the superior surface that has been compressed inferiorly; only in extreme cases are both superior and inferior surfaces compressed (Ellis, 1955, p. 141).

Compression fractures in the Indians of Gran Quivira were found in T-11 and T-12 and in L-1, L-2, and L-5 (table 89). Of four individuals, three were females, and all were at least 36 years of age at death. The frequencies in this series is much less than that observed for sled-using Sadlermiut Eskimos (Merbs and Wilson, 1960, p. 162), in which 54.1 percent of all adult columns had at least one fractured unit. Since there were so few fractures, a comparison between time periods and sexes was not possible.

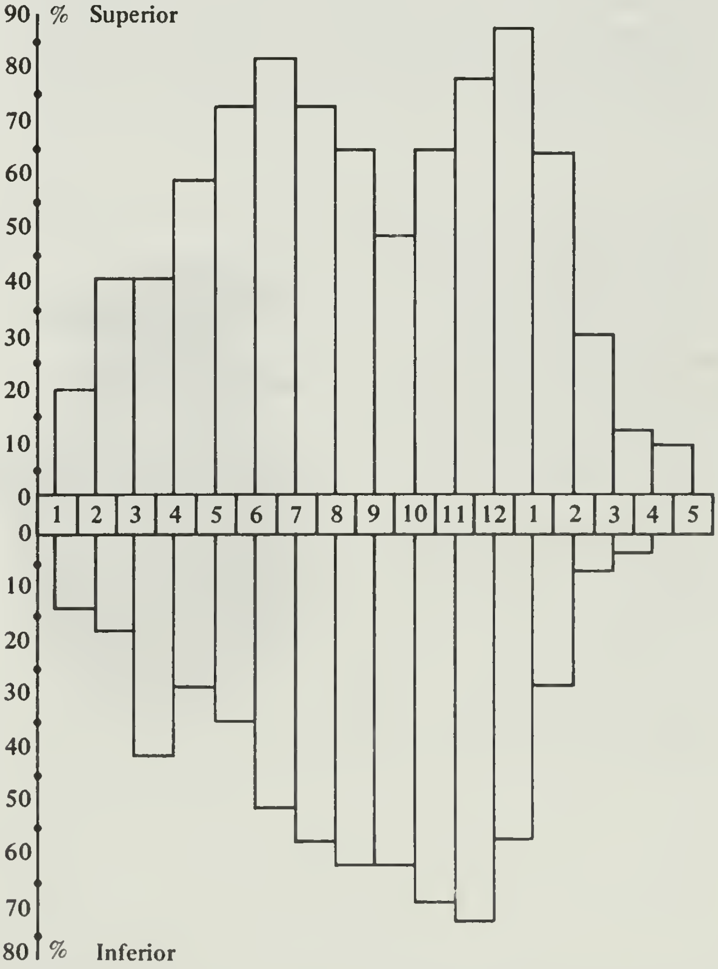
Laminal Exostoses

Laminal exostoses are small spurs or spicules on the anterior surface of the arches of the thoracic and lumbar vertebrae due to ossification of the *ligamenta flava.* The inferior spurs point downward from their position medial and anterior to the inferior articular facets, while the superior exostoses are located between the superior articular facets and are directed upward.

Figures 97 and 98 illustrate the frequency and distribution of laminal exostoses for all adult males and all adult females in the Gran Quivira series. There is little difference between males and



97. Regional distribution of laminal exostoses in the adult males of Gran Quivira.



98. Regional distribution of laminal exostoses in the adult females of Gran Quivira.

females, both for the frequency and the pattern of occurrence. Statistically, there are no differences when Early period males and females are compared ($X_1^2 = 0.9715, p = 0.50 - 0.30$), or when Late period males and females are compared ($X_1^2 = 0.4072, p = 0.70 - 0.50$); however, there is a highly significant difference between males and females of the Middle period in the total frequency for all vertebrae ($X_1^2 = 57.2455, p < 0.001$). When time periods are compared, there are no differences between males, but the females do differ significantly, due to the much lower frequencies for Middle period females than for any other group.

The occurrence of laminal exostoses was not found to increase appreciably with age. Indeed, the individuals in the 21-to-35-year-old age groups actually have greater frequencies than those in the 36-to-55-year-old age group.

In comparing the Indians of Gran Quivira with other populations, it can be seen that the frequency distribution is quite similar to that for Sadlermiut Eskimos, although the frequencies themselves are less than for Gran Quivirans (Merbs and Wilson, 1960, p. 163). Pietrusewsky (1969, p. 380), in a study of Tongan skeletal material, obtained frequencies closer to those found in this study; however, the distribution differed somewhat, with the greatest number of cases of involvement occurring in T-7 through T-9, rather than in T-10 through T-12, as was the case among Sadlermiut Eskimos and Gran Quivira Indians. McKern and Stewart (cited by Merbs and Wilson, 1960, p. 164) examined the vertebral columns of American Whites and obtained a distribution like that for Sadlermiut Eskimos (and thus also like Gran Quivirans), but found greater frequencies in the number of vertebrae affected. As was found in Gran Quivirans, Sadlermiut Eskimos exhibited little sex dimorphism and a lack of increasing frequency with age. Laminal exostoses, therefore, would seem to be a poor indication of age, sex, or race.

Osteoarthritis

Osteoarthritis (arthritis deformans, hypertrophic arthritis, chronic osteoarthritis, degenerative joint disease, or senescent arthritis), first recognized in the mid-19th century and named by Sir Archibald Garrod in 1890 (Sandison, 1968, p. 218), is one of the oldest and most widespread diseases reported in paleopathology (Ackerknecht, 1953, p. 123). No human population yet studied has been found to have been free from the disease, and it has even been diagnosed in Paleolithic man (J. Bourke, 1967, p. 361). Osteoarthritis is a degeneration of articular cartilage and bone; its characteristic eburnation of bone, osteophyte formation, and alteration of articular surface contour are readily recognized in dried specimens (Sandison, 1968, p. 219). The normal aging process has been considered one of, if not the, primary factors in the development of osteoarthritis. Although studies have shown that the disease increases in frequency with age (Roche, 1957, p. 434), even young adults have been found suffering from it (Hollander, 1953, p. 516). Trauma, static deformities, and strain are also important etiological factors in the development of osteoarthritis (Luck, 1950, p. 205).

In the Gran Quivira skeletal series, eburnation of the vertebral articular facets was quite rare, only two obvious cases having been found; both involved the fifth and sixth cervicals of females, one of age group 21 to 35 from the Early period, and the other of age group 36 to 55 from the Late period. More commonly found in this population were the growth of osteophytes on the edges of the facets, roughening of the articular surfaces, and changes in the contour of the facets (see fig. 99), all of which were graded on a scale of 0 to 3 (table 84). Figures 100 and 101 illustrate the patterns of osteoarthritis found in males and females, all periods and all scales of the disease. There are noticeable differences between the sexes. The greatest arthritic involvement in the

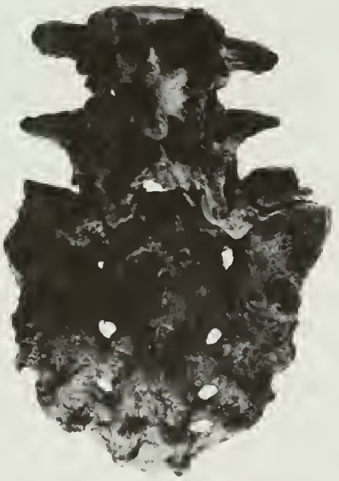
99. Heavy lipping of articular facets

100. Osteoarthritic pattern in the vertebral columns of all adult males of Gran Quivira

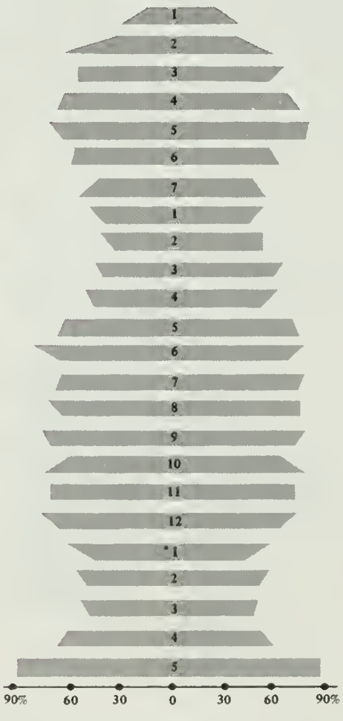
101. Osteoarthritic pattern in the vertebral columns of all adult females of Gran Quivira

102. Distribution of osteophytosis in the vertebral columns of the adult males of Gran Quivira

103. Distribution of osteophytosis in the vertebral columns of the adult females of Gran Quivira



99.



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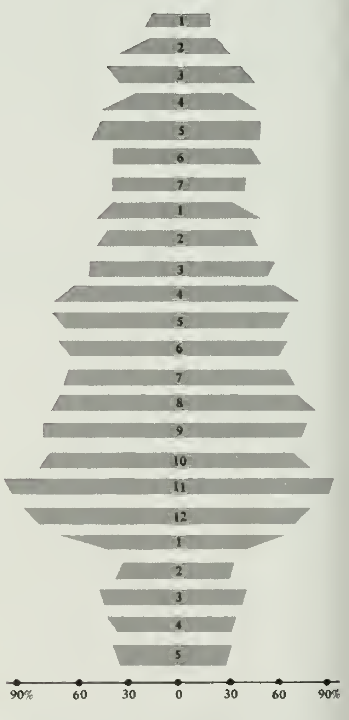


101.

males occurs in the mid-cervical, mid-thoracic, and lower lumbar regions, while for females, arthritic involvement is greatest in the mid- and lower thoracic vertebrae. Except for the Early period, in which the sample size is quite small, these differences also appear when comparing males and females within each period.

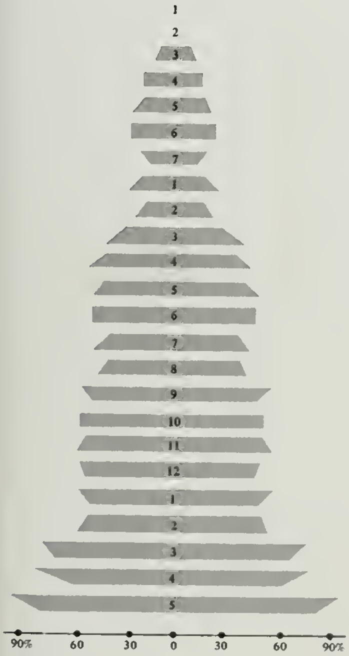
When comparing the patterns of each scale (table 84), osteoarthritic development of the slight (scale 1) and moderate (scale 2) grades exhibit the same sexual dimorphism as when the scales are pooled. However, the pronounced grade (scale 3) shows some differences—for males the cervical vertebrae and the thoracolumbar junction are the most frequently affected, but among females the cervical, mid-thoracic, and lumbar vertebrae are about equally affected.

It has already been well established that osteoarthritis increases with age, and this was also found to be true for Gran Quivirans. There were no young adults with the severe form.

Osteophytosis

Degeneration of inter-vertebral discs results in the formation of marginal osteophytes on the bodies of adjacent vertebrae. Softening and weakening of the inter-vertebral discs causes the annulus fibrosus to bulge outward, creating a bridge over which spurs and lipping form (Epstein, 1955, p. 210). The growth of osteophytes may progress so far that two adjacent vertebrae actually become united (Luck, 1950, p. 220).

Like osteoarthritis, osteophytes on the margins of the vertebral bodies were graded on a scale of 0 to 3 in this study (table 84). This distribution is like that for osteoarthritis—the highest frequencies in males are found in the lumbar region, while for females the thoracic region is most greatly affected (figs. 102 and 103). When the gradations of osteophyte formation are compared, males are seen to have suffered from greater frequencies of the severe scale than did females; in both sexes, however, the greatest frequencies are found in the lumbar region.



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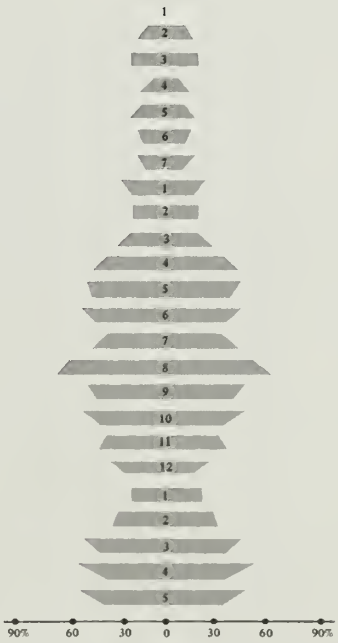


103.

Only three individuals were found to have segments united by the growth of osteophytes. All three were females, and all cases involved the upper thoracic region; a female of the Middle period, 36 to 55 years of age, had her third and fourth thoracic vertebrae united; a 21-to-35-year-old female of the Late period had her fourth and fifth thoracics united; and the third, fourth, and fifth thoracic vertebrae, as well as the sixth and seventh, of a 56-to-75-year-old female of the Late period were united.

Other Pathologies

In addition to the pathologies mentioned above, two Gran Quivirans suffered from less common and less easily diagnosed diseases.

The first of these individuals is a 56-to-75-year-old female of the Early Phase. The bodies of the upper thoracic vertebrae, especially the first two, have a very spongy appearance. Charles F. Merbs of the University of Chicago has diagnosed the condition as tuberculosis (fig. 104). Ritchie's findings of kyphotic spines in New York State, as well as art objects from all over the New World, seemingly attest to the presence of this disease in parts of the New World in pre-Columbian times (Ritchie, 1952, p. 309).

The diagnosis of the disease suffered by the second individual has not been firmly established, but the major suspects are juvenile rheumatoid arthritis or ankylosing spondylitis (Bennett, Burch, and Turner, Ms.). Except for the skull, the entire skeleton was affected. The bones are extremely thin and fragile, and the diaphyses are very narrow, while the epiphyses have a "blown out" appearance. Almost no post-cranial joint has escaped ankylosis. The vertebrae are so light as to seem to be hollow, and T-10 through S-1 are fused together. This unfortunate individual was a male of the Late Phase, 36 to 55 years old at death.

Summary

A skeletal series of 111 American Indians from a prehistoric-historic New Mexico pueblo with a 300-year span of occupation was examined for normal morphological variation, anomalies, and pathologies of the vertebral column. The morphological variants that were observed and compared with other populations were variation in the number of vertebrae, bridging on the atlas, double cervical *foramina transversarium,* and bifid cervical spines. In comparison with other non-Western peoples, spina bifida sacralis, spondylolysis, compression fractures, and vertebral fusion were found less frequently among Gran Quivirans. Laminal exostoses, osteoarthritis, and osteophytosis were the most common pathologies encountered in the skeletal series. Differences between the sexes were found to exist for osteoarthritis and osteophytosis, but not for laminal exostoses. Finally, two individuals with other pathologies were found: a prehistoric female with tuberculosis, and a historic Indian male with either juvenile rheumatoid arthritis or ankylosing spondylitis.

16. A Comparative Study of Facial Dimensions

Mahmoud Y. El-Najjar

Introduction

This report is a statistical study of facial size and form of a Rio Grande Pueblo Indian population from Pueblo de las Humanas in the Tularosa Basin of New Mexico. The objectives of the study are (1) to determine whether the two temporal populations at Gran Quivira may be considered homogeneous on the basis of metrical characters of the face and mandible, and (2) to compare these data to four other skeletal series in the Southwest (Pecos, Paako, Swarts Ruin, and Point of Pines) in order to evaluate the morphological affinities between these groups.

Age and sex determinations of the Gran Quivira skeletal material were done by E. K. Reed (Part 7) and C. G. Turner (Part 8). In the few cases where disagreement occurred, Turner's estimation was used. The present study is based on 17 male and 19 female crania and 21 male and 28 female mandibles. Only the skulls of young adults (age 21 to 25) were measured so that unwanted variation–due to incomplete growth in younger individuals and old-age tooth loss with its associated facial changes in older persons –would be avoided.

Due to the poor preservation of bone from the Early Phase, I was able to measure only one male and two females; the early period, therefore, is not included in this study. For the purposes of comparison, 21 measurements covering the major dimensions of the face and mandible are used. The measurements are in agreement with those made by Reed. The procedures of Hrdlička (1952) were followed.

Intra-Population Analysis

In this section, I will present the cranial size and form of the temporal series at Gran Quivira, and then, by considering the resemblances and differences, determine whether the series represents a single, continuous, and homogeneous population.These quantitative resemblances and differences can be quickly and briefly summarized. In the facial region, the upper facial height for the entire population at Gran Quivira falls in the mesene (medium face) category (45.0-54.9 mm.). Total facial height for the Middle and Late period male lies in the leptoprosopic (long, narrow face) category (85.0-89.9 mm.). Both males and females in the Middle period tend to have broader faces than those of the Late period, but in both males and females, the face shows only a moderate, or orthognathous, projection. Although the degree of projection shows minor intra-population variation, none of the Gran Quivira individuals is truly prognathic. The orbit in the two temporal sequences of both sexes is hypsiconch (long), and only breadth dimensions show some variation. In general, hypsiconch orbits may be considered characteristic of the Gran Quivira individuals. In the nasal region, the males of both Middle and Late Phases have a mesorrhine (47.0-50.9 mm.), or medium, nose, while the females have a platyrrhine (broad) nose. As for the maxilla, all individuals are characterized by a short and broad maxilla (brachyuranic). In summary, then, the male face in the Middle period is relatively longer, broader in all dimensions (biorbital, bizygomatic, and alveolar breadths), and less projecting than that of the Late period. The Middle period female face is longer and broader than in the Late period, although similar in the orbital, nasal, and alveolar region.

The mandibular ramus is slightly higher and broader in the Middle Phase males, while in the Late Phase females, the ramus is higher and broader. Although the corpus of the mandible is of moderate length in all individuals, it is slightly shorter in the Middle period for both males and females. In the female series, the Late period tends to have a slightly higher value for both breadths. However, the female sample in both cases is small, and the apparent differences could be attributed to sampling.

The intra-population differences of the bicondylar and bigonial breadths are, in general, similar to those recorded for the bizygomatic breadths, which, in the male series, are greater in the Middle Phase. The similarity of these dimensions is not unexpected, because these are the breadth measurements of structures that are directly involved with tooth support. In the male population, the bizygomatic, bigonial, and bicondylar measures consistently show the Middle period faces to be broader than those of the later population.

In the female series, there appears to be some irregularity in the facial breadths. The greater bicondylar and bigonial breadths of the Late period may indicate that the masseter muscle was better developed, and therefore produced a slight eversion of the angle of the mandible. Thus, in the Middle Phase males, the mandible is relatively shorter, broader, and absolutely higher than in the Late population. In the Middle Phase female population, it is short and narrow, while the ramus is lower and narrower than in the later population.

For the 21 measurements of all males and females, the level of significance was set at the 0.05 level. In comparing the Middle and Late Phase males, five of the above measurements are found to differ significantly (table 90): total facial height, biorbital breadth, maximum alveolar length, symphyseal height, and height of ascending ramus. Each one of these five measurements has a higher value for the Middle Phase males. In the female population, only two of these measurements are significantly different–minimum breadth of ramus, and incisural breadth, each of which has a higher value in the Late Phase. Since the inheritance of many of these characteristics depends on the combined influence of many genes (i.e., polygenic), it is difficult to determine whether similar skeletal forms have the same genetical background (Bielicki, 1962). Genetic characters of a population may change by four main processes–genetic drift, mutation, selection, and migration (L. C. Dunn, 1959; Dobzhansky, 1962; Grant, 1963). Genetically complex traits appear to be a poor source of information about mutation, selection, and drift, not because they cannot express themselves in terms of gene frequency, but because the action of these processes on such traits is likely to be slower (Birdsell, 1950, 1952). Birdsell suggested that the low sensitivity of these traits to the action of mutation, selection, and drift makes polygenic characteristics much more stable through time, resulting in their being far better markers of population affinities and more useful in historical reconstruction. Since any short-term genetic change in the metrical traits of a stable population is likely to result from admixture rather than from mutation, selection, and drift (Bielicki, 1962), it appears that polygenic characteristics offer the best basis for determining the effect of admixture. Two alternatives are suggested to best explain the differences between the temporal populations at Gran Quivira: admixture, and environmental changes.

Historical documents suggest the possibilities of Spanish or Plains Indians admixture at Gran Quivira (Scholes, 1937), as well as the likelihood of selective pressure due to drought and consequent nutritional deficiency (Vivian, 1964). Indians at the Pueblo de las Humanas were in contact with the Plains tribes who came to the pueblo to trade, and on occasion to raid, during the 17th century (Hackett, 1937; Hammond and Rey, 1953; Gunnerson, 1956), and who were accustomed to spending long periods in the vicinity. According to Vivian (1964), any direct contact with the Plains Indians was of short duration and was quite late in time. Evidence of Spanish mixture comes from Fray Alonso de Posadas, a contemporary of the period: "the morals of the hispanic community were exceedingly lax. Not even the clergy were free from vice, especially in their relations with Indian women" (Scholes, 1937, p. 140). Thus, the possibility of admixture has some historical support.

The second alternative is that of changes in some environmental conditions. The first Spanish expedition reached Las Humanas in A.D. 1598, and by 1629 there was a mission church at the pueblo (Scholes and Mera, 1940). The period between 1600 and the time of the pueblo's abandonment in 1672 was a tragic one for the Indians, as is evident from a report to the Viceroy on 22 March 1601:

> I have seen and observed that the natives pick the individual kernels of maize that fall to the ground; the Indian women will follow behind the loads for two leagues for this purpose. The Spanish seize their blankets by force leaving the poor Indian women stark naked, holding their babies to their breasts (Hammond and Rey, 1953, pp. 608-610).

According to Kelley (1955), the increase in Apache attacks, as well as malnutrition and starvation, may have lessened the resistance of the surviving Indians, so that they were easy prey to disease epidemics. There is also Fray Juan Bernal's statement (Hackett, 1937) that in 1669 alone, 450 of the inhabitants died of starvation following a 3-year drought.

Ivanovsky's (1923) study of the effect of starvation on bodily dimensions of a series of Russians showed a marked decrease in total facial height, bizygomatic breadths, upper facial height, nasal height, nasal breadths, and stature; he concluded that the lack of adequate food permanently affects the physique of the people subjected to starvation. In a similar study Andrews, (1943) reached the same conclusion. Tanner (in Baker and Weiner, 1966) found that malnutrition does affect individual bodily dimensions, as did Stini (1969), who noted that the Heliconia of Colombia, who live in a continual state of malnutrition characterized by a lack of protein and an excess of carbohydrate in the diet, are suffering from a severe retardation of skeletal growth. All of these observations can clearly be seen among the Late Phase population of Gran Quivira.

Inter-Population Comparison

Comparisons between Gran Quivira, Pecos, Paako, Swarts Ruin, and Point of Pines skeletons (see fig. 105) were done because: (1) the populations are all from the Southwest; (2) they represent large prehistoric populations of the region; (3) they are all in some part contemporaneous—Gran Quivira, A.D. 1315 to 1672; Point of Pines, pre-A.D. 400 to about 1450 (K. A. Bennett, 1967b); Pecos Pueblo, A.D. 1300 to 1838 (Kidder, 1958); Paako, A.D. 1350 to 1425 (Lambert, 1954); and Swarts Ruin, about A.D. 950 to 1150 (Cosgrove and Cosgrove, 1932).

The mean values of my measurements for males and females of the five groups are given in Tables 91 and 92, respectively. As a measure of between-group divergence using a number of characteristics, I have chosen the coefficient of divergence (C.D.)—a statistic that was initially devised by Klauber (1940) and later modified by Clark (1952). A simple and clear statistic, it is suitable for small-scale studies such as this one. The formula is:

$$\text{C.D.} = \sqrt{\frac{(a_1 - b_1)^2 + (a_2 - b_2)^2 + (a_k - b_k)^2}{K}}$$

Where $a_1 = \dfrac{A}{A_i + B_i}$ and $b_1 = \dfrac{B}{A_i + B_i}$,

A_i = the mean of the *i*th measurement in population A,

B_i = the mean of the *i*th measurement in population B,

K = the number of measurements.

The coefficient of divergence (table 93) shows that the skeletal samples from Gran Quivira and Pecos have the least between-group differences, while the greatest differences are found between the samples from Gran Quivira and Paako. Although some of the mean values are statistically significant, it is the relative degree of similarity of differences between these groups that is of importance. Laughlin and Jørgenson (1956) believe that inferences concerning relationships do not depend on statistically significant differences, but rather on the relative amount of differences. A summarized general comparison between the facial indices of Gran Quivira, Pecos, Paako, Swarts Ruin, and Point of Pines follows.

Upper facial height: All groups have an average-sized face.

Total facial height: The Gran Quivira Middle and Late male groups are leptoprosopic, or narrow-faced. The females of both series are in the mesoprosopic (intermediate) class. Pecos, Paako, Swarts Ruin, and Point of Pines fall in the mesoprosopic category.

Orbital height: All are in the high or hypsiconch class.

Nasal height: At Gran Quivira, males of both periods have a mesorrhine nose, while females have a platyrrhine nose. All others have a platyrrhine nose.

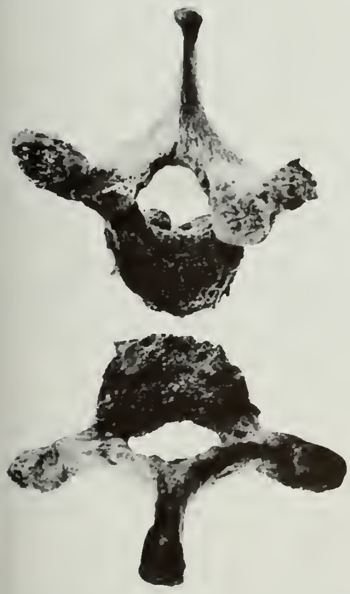
Palate form: All are characterized by a brachuranic maxilla.

Gnathic index: All but Swarts Ruin are orthognathous or vertical-faced; the Swarts Ruin individuals are in the prognathous category.

The individuals from Gran Quivira, with minor individual exceptions, represent a population essentially of the Southwest Plateau physical variety. The languages of Paako, Swarts Ruin, and Point of Pines are unknown. (Both Point of Pines and Paako were abandoned by 1450, and Swarts Ruin even earlier.) The Indians of Gran Quivira spoke Piro, one of the Tanoan languages (Vivian, 1964).

In Part 7, Reed pointed out that in some morphological features and in the general appearance of the skull, the Gran Quivira Indians differ from the average Puebloan crania. He further indicated that there are certain individuals definitely not of Puebloan type who may represent an intrusive element from the Plains. Metrically, however, the crania from Gran Quivira are not much different from the limits of the Southwest Plateau variety. The means differ to some extent from those of "typical" Southwest values, but the ranges are almost identical. Based on a type of cranial deformation that is not the cradleboard flattening found in Pueblo material, as well as the presence of many tall individuals and the occurrence of non-Southwestern features of the skull vault and face, Reed suggests that some individuals at Gran Quivira resembled the Plains Indians, or the Otamid variety. In any event, since all pueblo-living people were subject to outside intrusion, it is possible that the differences exhibited between the five groups are due to differences in the amount and kind of intrusion.

From the data presented here, it is fairly clear that while there is some difference of opinion on the identity and biological affinity of the Gran Quivira Indians, the weight of morphological evidence indicates that they were basically Pueblo Indians of the Rio Grande Anasazi stock, although admittedly large-sample statistical data on the Plains Indians is unavailable for comparison. The metrical features of the Gran Quivira skeletal series is within the limits of Southwest Plateau Indian variety. The evidence viewed by Reed favoring a non-Puebloan affiliation (deformation, stature, and skull morphology) is certainly there, but not easily differentiated into true genetic affiliation and false environmentally induced similarities, including the obvious cultural aspects of cranial deformation. Historical evidence shows that contact with Plains Indians did occur, but that it was probably of short duration (Vivian, 1964) and relatively late in time (Hackett, 1937; Hammond and Rey, 1953). The human skeletal remains from Gran Quivira, however, do not exhibit strong evidence of this relationship.



104. Effects of tuberculosis on thorocic vertebrae.

Tables

Table 1.
Pottery associated with the surveyed sites.

Site Number	Location*	Type of Site†	Kana'a Gray	Lino Gray	Jornada Brown	Brown Ware Smudged	Uniden-tified R/b	Uniden-tified Brown	Corona Corrugated	Corona Plain	Los Lunas Smudged	Pilares Banded	Uniden-tified Corrugated	Uniden-tified Plain	Wingate B/r
9001	NW								15	3					
9003	NW	SC			1										
9004	NW	J			14	1			13	5					
9005	NW	J		1	13										
9007	NW	EM				1			64	1					
9008	NW	LM						1		63					
9009	NW	EM							52	2			2		1
9010	NW	J			1	1			3	7					
9011	NW				74			5							
9012	S	J-EM			44	1			3	51					2
9013	S	J			31		3	2	8	2					3
9014	S	J-EM			10	1	2		41						
9015	S	J			13	1			23						
9016	S	J-EM	1		13	1	2		37						
9017	S	J			36										
9018	S	P		47											
9019	S	P			76	8							1		
9020	S	P			36	2									
9021	S	P-J-EM			46				24		1				
9022	S	J			10			1	14	4	4		1	1	
9023	S	J			11				13	4		2	1		
9024	S	J			20	1			18	3	1	1		2	2
9025	M	J-W			4										
9026	S	J			27			1	16	7					1
9030	S	J			53		3	1	6		2				
9031	S	J							5					1	
9032	M	J-EM			1				18	5				4	
9033	M	W			3										
9034	M	W							1					5	
9035	M	W	1					1							
9036	H	W			3										
9037	H	W		1	60									1	
9038	H	?	1		88	6							2		1
9039	H	P			62										
9040	H	P			130		1								1
9041	H	P			82				2		2				
9043	NW	LM				1					44				
9044	NW	W													

Table 1.
Continued.

Site Number	Location*	Type of Site†	Lincoln B/r	Unidentified Red Ware	El Paso Polychrome	Heshotauthla Polychrome	St. Johns Polychrome	Casa Colorado	Cebolleta B/w	Chaco B/w	Chupadero B/w	Galisteo B/w	Kiatuthlana B/w
9001	NW										2		
9003	NW	SC		5									
9004	NW	J					3	1			5		
9005	NW	J									2		
9007	NW	EM		10			3	2			35		
9008	NW	LM		63									
9009	NW	EM		2				1			18	1	
9010	NW	J						2			18		
9011	NW												
9012	S	J-EM		7				7			17		
9013	S	J				1	2		4		99		
9014	S	J-EM	5	1	1		8				74		
9015	S	J	2	3			2				63	2	
9016	S	J-EM	1		1	1		7			90		
9017	S	J						1	1		6		
9018	S	P									5		
9019	S	P							2		11		
9020	S	P											
9021	S	P-J-EM		3		2			1	1	58	1	
9022	S	J		2					1		56		
9023	S	J									52		
9024	S	J		3							68	5	
9025	M	J-W									3		
9026	S	J		1		2	2	10			42	5	
9030	S	J							11		86	1	
9031	S	J						4			28		
9032	M	J-EM			2								
9033	M	W		12									
9034	M	W		5				1			1		
9035	M	W						1			10		
9036	H	W									2		
9037	H	W						5			8		
9038	H	?									7		
9039	H	P						1			33	1	
9040	H	P						8	1		13		1
9041	H	P											
9043	NW	LM		66									
9044	NW	W											

Table 1.
Continued.

Site Number	Location*	Type of Site†	Mancos B/w	Mesa Verde Tradition B/w	Mimbres B/w	Mimbres Bold Face	Poge B/w	Puerco B/w	Red Mesa	San Marcial	Santa Fe B/w	Socorro B/w	Tabirá B/w	Tularosa B/w	Uniden-tified B/w
9001	NW														
9003	NW	SC													
9004	NW	J		1					1						
9005	NW	J													
9007	NW	EM		3			1								
9008	NW	LM											2		
9009	NW	EM										4			
9010	NW	J													
9011	NW														
9012	S	J-EM									1		3		
9013	S	J					1		1						3
9014	S	J-EM							1			14			
9015	S	J													
9016	S	J-EM									3	2			
9017	S	J													5
9018	S	P						2	4			4			3
9019	S	P			1				2			7			1
9020	S	P						2							
9021	S	P-J-EM									2	2			3
9022	S	J							2		1	5			
9023	S	J							2			1			4
9024	S	J													4
9025	M	J-W													
9026	S	J					1		1			3			
9030	S	J	1							1		4			4
9031	S	J													1
9032	M	J-EM													
9033	M	W													
9034	M	W													1
9035	M	W													1
9036	H	W													1
9037	H	W							3			1			
9038	H	?						2	5						1
9039	H	P		1								2			3
9040	H	P							5						2
9041	H	P							2	1					
9043	NW	LM													
9044	NW	W													

Table 1.
Concluded.

Site Number	Location*	Type of Site†	Chupadero White Ware	Unidentified White Ware	San Andres R/t	Klageto B/y	Agua Fria G/r	Pinnawa G/w	Puaray G/p	San Clemente G/p	San Lazaro G/p	Tiguex G/p	Unidentified Glaze Ware	Totals
9001	NW													20
9003	NW	SC					1						1	8
9004	NW	J	11	1										56
9005	NW	J		1										17
9007	NW	EM	21	1										142
9008	NW	LM					1		1		1		58	190
9009	NW	EM	6	2										94
9010	NW	J		1										33
9011	NW				1									80
9012	S	J-EM								1			3	140
9013	S	J	27	2										189
9014	S	J-EM	14	1	1		1							175
9015	S	J	51										1	161
9016	S	J -EM											7	166
9017	S	J	17	3										69
9018	S	P	10	8										83
9019	S	P	9	1	1									120
9020	S	P												40
9021	S	P-J-EM	28											172
9022	S	J	28		1									132
9023	S	J	38	2										130
9024	S	J	2	47										177
9025	M	J-W	20	2			1				1		1	32
9026	S	J	43		1									163
9030	S	J	57			1								231
9031	S	J	7	2										48
9032	M	J-EM												30
9033	M	W		2									2	19
9034	M	W												14
9035	M	W												14
9036	H	W	3										23	32
9037	H	W	16	11										106
9038	H	?		8										121
9039	H	P	13					1						117
9040	H	P	35						1					198
9041	H	P		2										91
9043	NW	LM							1			1	77	190
9044	NW	W		3					1			2	13	19

*Location:
NW = Northwestern area of Chupadero Mesa, including the Abó area.
S = Southern area, or area southwest of Gran Quivira
J = Jumanes Mesa area
M = Medano, the plains north and east of Gran Quivira

†Type of Site:
P = Pithouse
J = Jacal
EM = Early masonry structure
LM = Late masonry structure
SC = Stone circles
W = Water sources: lakes, ponds, springs

Table 2.
Sherd count from adobe-lined pit.

	Number of Sherds	Percentage of Total
Chupadero Black-on-white	275	63
Corrugated Utility	91	21
Klageto Polychrome	26	6
Heshotauthla Polychrome	21	5
Rio Grande Glaze	4	1
Jornada Polychrome	1	T
Unidentified	19	4
Totals	437	100

Table 3.
Plastered rooms and kivas.

Room No.	Plastered Walls	No. of Layers	Wall-liner Only	No. of Decorated Layers	Estimated Date of Construction	Remarks
6	N		X			
7	NESW		X			
12	NEW	31		18	1545	See layer description
15	N	1			1545	White gypsum
16	NSW	6			1545	
17	NES	1			1545	
18	W	6			1564	
25	E		X		1545	
28	NESW		X		1564	
31	E	3			1545	
33	W	3			1545	
35	NSW	10?			1545	Several layers white gypsum
39	W		X		1564	
43	N	12		3	1564	See layer descriptions
45	ESW		?		1564+	
46	E		X		1545	
47	E		X		1561+	
49	S		X		1564	
56	S	2			1564+	
59	NESW	25			1545	
70	NEW	9			1554	
78	E	6			1554	
90	ESW	6 or 7			1554	
94	ESW	8			1554	White, black, brown alternately
96	SW		X		1554	
101	NEW		X		1564	
105	NESW	1 or 2			1554	
106	NW	4 or 5			1564	Bottom layer white gypsum
107	NS				1554	
108	W	2 or 3			1564	
109	NW	8 or 9			1554	1 layer white gypsum
110	NW	6 or 7			1564	3 white gypsum
111	W		X		1564	
119	SW	6		2	1564	See layer description (occupied until abandonment, A.D. 1672)
133	NE	9 or 10			1599	Second layer white gypsum
136	NESW	6 or 7			1599	Second coat from wall is wood ashes
141	E	1 or 2			1599	Gypsum
143	ESW	1 or 2			1554	
144	ES	2 or 3			1599+	Bottom layer white gypsum
146	NES	4 or 5			1554	Bottom layer white gypsum
147	NESW	4 or 5			1554	
148	NESW	10		1	1600+?	See layer description (occupied until abandonment, A.D. 1672)
149	NE	4 or 5			1545	
150	NESW	2 or 3			1554	
154	E	3 or 4			1600+?	Also 1 brown coat on mid-phase wall below floor
157	W		X		1600+?	
161	NS	5			1545	
168	NEW	18		2	1545	See layer description
169	S	?	?		1554	
171	S	?	?		1554	
173	NESW	2?			1545	Drawing on stone under plaster
175	NESW	?	?		1545	
178	E		?		1545	
179	N	?			1545	
180	NE		X		1545	
181	NS		X		1545	
182	N		X		1545	
186	W	?			1545	
189	E		X		1545	
196	NES	?			1545	1 white layer
197	NESW	8			1545	
199	NES	?			1545	
202	ES	2			1545	
204	NESW	7			1545	
205	NESW	11		2	1545	See layer description
208	NE	4?			1545	Plastered over wall-liner, burned, replastered over new liner
213	SW	4 or 5			1545	
215	N	2 or 3			1630	*Convento* room
216	NES		?	?	1630	*Convento* room
220		5		3	1545	*Convento* room; see layer description from fill
221	N	1 or 2			1630	See layer description; *convento* room
223	S	1 or 2			1630	*Convento* room
225	N		X		1630	*Convento* room
226	N				1630	*Convento* room; plaster revealed in doorway
Kiva C		2			1545?	Possibly more
Kiva K	N?W	9–		2	1473	See layer description
Kiva L	E	20		5	1400's	See layer description
Kiva M		10			1564?	Plaster from fill and intack?
Kiva N	NESW	31		24	1416	See layer description
Area I		1				General fill from trash area.
Room 26		4		1	1545	Not true room, general trash fill. Murals probably from elsewhere. Top layer had 1 narrow white line.

Table 4.
Paint and plaster analysis.

Description	Material	Provenience
White wall plaster	Calcite, cryptocrystalline, (caliche)	Area I, general fill Room 215, north wall Kiva N, Layer 30, east wall
	Gypsum	Room 220, Layer 1, fill
	Gypsum (cryptocrystalline)	Kiva N, Layer 18, east wall
	Gypsum with some calcite (cryptocrystalline)	Room 226, fill
White paint	Gypsum, cryptocrystalline with asbestos form mineral (needles and cluster of fibers), colorless to pale green, parallel extinction, 1.54	Room 12, north wall, northwest corner, layer ?
	Gypsum, cryptocrystalline	Kiva N, Layer 8, southwest wall Kiva N, Layer 16, NW, N, NE sections
White clay sample	Caliche, cryptocrystalline calcite probably from Cca soil horizon.	Room 3, subfloor
Red paint	Hematite	Room 26, general fill Kiva N, Layer 21, east wall
	Hematite, earthy	Room 168, Layer 18, north wall, northeast corner Kiva L, Level 5 Kiva N, Layer 16, NW, N, NE section Kiva N, Layer 18, east wall Kiva N, Layer 24, east wall Kiva N, Layer 29, east wall
	Hematite, earthy, mixed with crystalline calcite	Room 220, Layer 1, fill
	Clay mixed with pigments; unidentified mineral and hematite, micaceous, submetallic luster	Kiva N, Layer 17, east wall
Moderate red paint	Unidentified mineral and hematite, micaceous, submetallic luster	Kiva N, Layer 18, east wall
Purple paint	Unidentified mineral and hematite, micaceous, submetallic luster	Kiva N, Layer 18, east wall
Orange paint	Hematite	Kiva N, Layer 18, east wall
Yellow paint	Limonite	Kiva N, Layer 18, east wall Kiva N, Layer 21, east wall
	Limonite, earthy	Kiva L, Level 5 Kiva N, Layer 16, NW, N, NE sections Kiva N, Layer 21, east wall
	Limonite with some jarosite (jarosite alters easily to limonite)	Kiva N, Layer 30, east wall
Black paint	Magnetite and carbon (?)	Kiva L, Level 5
	Magnetite and carbon (?) (no manganese)	Kiva N, Layer 18, east wall
Turquoise paint	Chlorite? (mixed with white base); possibly from chlorite schist)	Kiva N, Layer 18, east wall

Table 5.
Kiva N, Trait Summary.

X – Present ? – Doubtful presence – – Drawing I – Termination point uncovered

	Layer No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Plaster Presence	NW	X	X	X	X	XI	X	X	X	X							X	X	X	X	X	X	X	X	X	X	X	X	X			
	N	X	X	X	XI		X	X	X	X	IX	IX					X	X	X	X	X	X	X	X	X	X	X	X	X			
	NE	X	X	XI			X	X	X	X	IX	IX					X	X	X	X	X	X	X	X	X	X	X	X	X	IX	IX	IX
	E		X				X	X	X	X	X	X					X	X	X		X	X	X	X	X	X	X	X	X	X	X	X
	SE	X	X	X	X		X	X	X	X			X	X		X	X	?	X	X	X	X	X	X	X	X	X	X	X			
	S	X	X	X	X	IX	X	X	X	X			X	X		X	X	?	X	X	X	X	X	X	X	X	X	X	X			
	SW	X	X	X	X	X	X	X	X	X			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			
	W	X	X	X	X	X	X	X	X	X			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			
Color	Brown	X		X			X	X	X			X	X		X	X	X	X								X						
	Gray		X	X	X			X	X	X	X					X	X	X			X	X	X	X						X		
	White					X				X	X			X					X	X	X	X	X	X	X		X	X	X		X	X
Height	Low					X														X				X				X			X	X
	Variable																		X										X			
Grime		X	X		X		X		X	X						X	X			X	X	X	X			X	X	X	X			
Backing		X					X				X					X		X	X	X					X	X					X	
Guide Layer			X				X	X								X			X					X					X			
Decorations Presence	NW	X				X	X	X									X									X		X				
	N	X					X	X									X									X		X	X			
	NE	X		X			X	X									X	X	X			X									X	X
	E						X					X						X	X			X	X		X	X					X	X
	SE						X										X															
	S	X		X			X			X			X	X			X															
	SW	X		X			X		X	X					X	X	X					X				X						
	W	X		X	X	X	X										X															
Color	Red	X		X		X	X	X		X		X	X		X		X	X	X			X			X	X					X	
	Yellow	X		X			X	X		X		X	X			X	X	X				X	X		X	X					X	X
	Gray							X														X			X						X	
	White	X		X	X		X	X	X				X	X	X	X	X		X						X			X			X	
	Brown						X	X									X														X	
	Other						X					X						X	X													
Elements	Dots	X		X	X		X	X	X	X			X	X	X	X	X						X									
	Verticle lines	X		X			X	X	X					X	X	X						X						X			X	X
	Bands	X		X			X										X															
	Triangle						X										X															
	Masks and anthropomorphic						X					X					X															
	Birds							X					X																			
	Quadrupeds	X																														
	Plants	X																														
	Other	X		X		X	X	X	X					X			X	X	X						X					X	X	
	Unidentifiable	X					X	X	X	X		X	X				X		X			X			X							
Redecoration							?	X						X											X						X	
Drawings	NW	X				X		X	X								X									–		–				
	N	X					X	X									X									–		–	X			
	NE	X		X			X	X									X		X			X									X	–
	E						X					X						X	X			X	–		X	–					X	–
	SE												X				X															
	S	–		X			X			–				X			X															
	SW	X		X		X				X				X	–	X						–				–						
	W	–		–	–	–	X										X															
Figures		20 21		22			23 –27	28				29	30	31			32 –36	37	38			39			40						41	

Table 6.
Kiva N: Plaster and paint colors.*

Layer	Figure	Plaster Colors	Paint Colors
1	20, 21	Brown 7.5YR4/2 and dark brown 7.5YR4/4; backing–light gray 7.5YR7/0 and 10YT7/2	Dark red 7.5R3/8 Yellow 2.5Y7/8 White Black
2		Gray 5Y6/1, olive gray 5Y4/2, and dark gray 10 YR4/1	
3	22	Brown 10 YR5/3, pale brown 10YR7/3, light yellowish brown 10YR6/4, and light brownish gray 2.5Y6/2	Dark red 10R3/6, 7.5R3/8 Yellow 5Y7/8
4		Light gray 5Y7/1 and 7/2	White
5		White	Dark red 7.5R3/8
6	24-27	Brown 7.5YR4/2 and 5/4, pale brown 10YR6/3, light yellowish brown 10YR6/4, light brownish gray 10YR6/2, and dark gray brown 2.5Y4/2; backing–gray 5Y7/2, light gray 10YR7/1 and 2.5Y7/2	Red 7.5R4/6 and 4/8 Dark Red 7.5R3/8 Yellow 2.5Y7/8, 5Y7/8, and 8/8 Orange ? (red on yellow) Dark yellowish brown 10YR4/4
7	28	Off-white (grayish), and pale yellow brown 2.5Y7/4 and very pale brown 10YR7/3	Red 10R5/6 and 7.5R4/8 White Black Yellow 2.5Y7/8 Olive yellow 2.5Y6/8 Brown 10YR5/3 Light gray 7.5YR7/0 Gray 5Y5/1
8		Light reddish brown 5Y6/3, pale brown 10YR6/3, very pale brown 10YR7/3, light brownish gray 10YR6/2, and light gray 10YR7/2	Yellow 10YR7/8 White
9		White and light gray 10YR7/1	Red ? Black
10		White and light gray 10YR7/1 (slightly lighter); backing–light brown?	
11	29	Very dark gray brown 2.5Y3/2	Black Dark red 7.5R3/8 Dusky red 10R3/2 Yellow 2.5Y7/8 Turquoise ?
12	30	Yellowish brown 10YR6/6, and light yellowish brown 10YR6/4	Red 7.5R4/6 Yellow 2.5Y7/8 White Black
13	31	White and pinkish white 7.5YR8/2	White
14		Reddish brown 5YR4/3	Red 7.5R4/6 White
15		Pale brown 10YR6/3, light brown gray 2.5Y6/2, light gray 2.5Y7/2, and pale olive 5Y6/3; backing–very pale brown 10YR7/4 and light brown 7.5Y6/4	White
16	33-36	Light brown gray 10YR6/2, light gray 10YR7/2 and 2.5Y7/2, light olive gray 5Y6/2, light brownish gray 2.5Y6/2, and pale brown 10YR6/3	Red 7.5R4/6, 10R4/6 and 4/8 Yellow 2.5Y7/8 White Black Brown (see plaster)
17	37	Gray 7.5R5/0 and 10YR5/1, very dark grayish brown 10YR4/2, and light brownish gray 10YR6/2, backing–light brown 7.5YR6/4	Pale red 10R6/2 Weak red 7.5R5/2 Dark red 7.5R3/8 Yellow 2.5Y7/8 Turquoise ? Orange (yellow over dark red) Black
18	38	White, backing–gray 10YR7/1 and light gray 2.5Y7/0	Moderate red 5R5/4 Dark red 7.5R3/8 Very dark red 5R2/8 Yellow 2.57/8 Orange and reddish orange (?) White Black Very dark gray 7.5YR3/0 Turquoise 5BG7/2 (needs more blue) Very dusky purple 5P2/2 Very dusky red-purple 5RP2/2
19		White, backing–brown 10YR5/3, yellowish brown 10YR5/4, and pale brown 10YR6/3	
20		White, gray 7.5YR5/0, light gray 10YR7/1, and light olive gray 5Y6/2	
21	39	White, light gray 2.5Y7/2 and 7.5YR7/0	Dark red 7.5R3/6 Brownish yellow 10YR6/8 Black
22		White, light gray 10 YR7/1 and 5Y7/2, light brownish gray 10YR6/2	Yellow 5Y8/6
23		White, light gray 10YR7/1	
24	40	White, backing–light brownish gray 2.5Y6/2, light olive gray 5Y6/2, and pale olive 5Y6/4	Dark red 7.5R3/6 and 3/8 Very dusky red 7.5R2/4 Olive yellow 2.5Y6/6 or 6/8 Brownish yellow 10YR6/8 Light brownish gray 2.56/2 White
25		Brown 10YR5/3, light brown 7.5YR6/4, light brownish yellow 10YR6/4, and yellowish brown 10YR5/4	Dark red 7.5R3/6 Yellow 5YR/6
26		White	
27		White	White
28		White and pinkish white 5YR8/2	
29		Gray ? or off-white	
30	41	White, backing–light gray 2.5Y7/2	Red 2.5YR4/6 Dark red 2.5YR3/6 and 7.5R3/8 Pale red 2.5YR6/2 Very dusky red 7.5R2/4 Yellow 2.5Y7/8 Brownish yellow 10YR6/8 Light brown 7.5YR6/4 Light gray 5YR6/1 and 5Y7/2
31		White	Yellow 2.5Y7/8

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*Based on the Rock Color Chart (The Geological Society of America, 1963) and the Munsell Soil Color Charts (Munsell Color Co., Inc., 1954).

Table 7.
Other rooms and kivas: trait summary.

Room or Kiva		43			119					148		168									205								220					K			L	
Layer No.		?	?	11	1–2	3	4	5	6	1–8	9	1–7	8	9	10	11–12	13–14	16	17	18	1–3	4	5	6	7	8	9	10	1	2	3	4	5	unknown at least 9 layers and probably more			Last	
Plaster Presence	N	X	X	X						X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X								X	X	
	S				X	X	X	X	X	X	X										X	X	X	X	X	X	X	X										
	E									X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X						X	X			
	W				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X										
Color	Brown				?				X		X	X	X	X			X	X	X	X	X			X		X		X		X	X	X		U		X	X	U
	Black		X		?																																	
	Gray														X												X											
	White					X	X	X								X						X		X		X			X				X					
Low Height						X																											X					
Grime						X			X		X	X			X																							
Backing								X										X				X				X						X						
Decorations Elements	Dots	X		X					X		X														X												X	U
	Vertical lines			X					X		X															X												
	Anthropomorphic						X						X								X																	
	Geometric or Other		X				X													X					X	X						X						
	Unidentified						X																						X	X						X	X	
Color	White	X					X		X		X		X												X							X			X	X	X	X
	Red						X						X							X									X	X				X	X			X
	Yellow						X						X																									X
	Black						X						X							X					X				X									X
	Other											X														X												
Drawing	N	–	X	–								X								X					X											X		
	S										–																											
	E																																					
	W						X		X		–															X								–	–			
Figures							52						53												54													

Table 8.
Kivas K and L: Plaster and paint colors.*

Kiva	Layer	Figure	Plaster Colors	Paint Colors
K	1-3		Unknown	
	4		Brown 7.5YR5/4	
	5		Reddish gray 5YR5/2	White
	6		Gray 5YR5/1	
	7		Brown 7.5YR5/4	
	8		Dark gray 10YR4/2	
	9		Dark grayish brown 10YR4/2	White
	?	42a	Brown ?	White
L	?	42b	?	Unknown: Dark orange Red White Black Dark gray
	?		?	Red 10R4/6, 2.5YR3/6 Dark red 7.5R3/8 Yellow 5Y7/8 Olive yellow 2.5Y6/8

*Based on the Rock Color Chart (The Geological Society of America, 1963) and the Munsell Soil Color Charts (Munsell Color Co., Inc., 1954).

Table 9.
Room 12, Trait Summary.

	Layer No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	?	?	?	?	?	?	?	?
Plaster Presence	E	See Room 12 notes—at least 23 layers present.																														X	X	X	X	X	X	X	X
	N	X	X	X	X																		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			
	W	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X								
Color	Brown	X	X	X	X		X		X	X	X			X	X			X		X	X	X	X	X	X	X	X		X	X	X	X				Unknown				
	Red					X										X																				Unknown				
	Gray							X				X	X			X						X														Unknown				
	White																X		X									X								Unknown				
Low Height																			X																	Unknown				
Grime-Coated		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X		?	X	X	X	X	X	X	X	X	X	X	X	X				Unknown				
Backing					X						X	X		X		X			X											X						Unknown				
Decorations Elements	Dots																					X		X		X	X						X	X	X		X	X	X	
	Verticle lines	X										X			X	X						X		X		X	X						X	X	X		X	X	X	
	Anthropomorphs		X	X												X																								
	Other			X				X				X			X		X			X		X		X		X	X			X		X							X	
	Unidentified		X																																	X				
Wall Paint												X												?																
Color	White	X	X	X	X		X				X				X	X				X		X		X			X						X	X	X	X	X	X	X	X
	Red		X		X											X						X														X				
	Yellow															X																								
	Black		X		X							X				X	X			?				X			X									X				X
	Other															X														X										
Redecorated															X					?				?			X													
Wall	East																																	X				X	X	X
	North																											X			X			X	X	X	X	X		
	West	X	X	X	–		X		–	–		X			X	X	X				X		X		X		X	X					X							
Drawing	East																																–					–	–	X
	North																										X						–	–	–	X	–			
	West	X	X	X	–		X		–	–		X			X	X	X					X		X		X	X					X								
Figures				46			45					46				47	42c					48		49		50	51									43				

X = Present
? = Doubtful presence
– = Drawing

Table 10.
Room 12: Plaster and paint colors.*

Layer	Figure	Plaster Colors	Paint Colors
1		Dark brown 7.5YR4/4 and dark yellowish brown 10YR4/4	White
2		Dark yellowish brown 10YR4/4 and yellowish brown 10YR5/4	Red 7.5R4/8 White Black
3	44	Brown 7.5YR5/4 and dark yellowish brown 10YR4/4	White
4		Dark brown 7.5YR4/4, and 10YR4/3; backing—weak red 2.5YR4/2	Unknown: Red White Black
5		Pale red 2.5Y6/2	
6	45	Dark yellowish brown 10YR4/4	White
7		Pinkish gray 7.5YR6/2 and 7/2	
8		Brown 10YR5/3 and yellowish brown 10YR5/4	White (or Layer 9)
9		Brown 7.5R5/4 and 10YR5/3	See Layer 8
10		Pale brown 10YR6/3; backing—brown 7.5YR4/4	
11	46	Light gray 2.5Y7/2; backing—brown 10YR5/3	White Black
12		Pale brown 10YR6/3	
13		Brown 10YR5/4 and yellowish brown 10YR5/3; backing—yellowish brown 10YR5/3	
14		Brown 7.5YR5/4 and pale brown 10YR6/3	White
15	47	Gray 5Y6/1 and brown 10YR5/3	Red 7.5R4/8 and 10YR4/8 Yellow 2.5Y7/6 and pale yellow 5Y7/4 White Black Very dark gray 7.5YR3/0 Light bluish gray 5B7/7 (actually should have more blue in it)
16	42c	White	Black
17		Dark yellowish brown 10YR4/4	
18		White; backing—brown 7.5YR5/4	
19		Pale brown 10YR6/3	White
20		Brown 10YR5/3	
21	48	Brown 10YR5/3, gray 10YR5/1, and grayish brown 10YR5/2	Red 10R4/6 White
22		Dark brown 7.5YR3/2, 4/2, and 4/4	
23	49	Dark brown 7.5YR4/2, dark grayish brown 10YR4/2, and reddish brown 5YR5/4	White
24		Dark brown 10YR4/3	White
25	50	Pale brown 10YR6/3	White
26	51	Brown 10YR5/3 and gray brown 2.5YR5/2	Black
27		White	
28		Dark brown 7.5Y4/2 and grayish brown 10YR5/2	
29		Dark brown 10YR4/3 and 5/3	Dark red 7.5R3/6 White Black Pale brown 10YR6/3
30		Brown 10YR5/3 and grayish brown 2.5Y5/2	
31	42d	Brown 7.5YR4/4 and 5/4	White
?	43	?	Red White Black (See Room 12 Introduction, east wall)

*Based on the Rock Color Chart (The Geological Society of America, 1963) and the Munsell Soil Color Charts (Munsell Color Co., Inc., 1954).

Table 11.
Miscellaneous rooms: Plaster and paint colors.*

Room	Layer	Figure	Plaster Colors	Paint Colors
119	1-2		"Dark colored"	
	3		White	
	4	52	White	Red 7.5R5/8 and 4/8, 10R5/8 Yellow 2.5 Y7/8 White Black
	5		White	
	6		Brown ?	White
	Liner		Dark gray 7.5 YR4/0	
168	1-4		Unknown	
	5		Reddish brown 7.5YR4/3	
	6		Reddish brown 10YR4/3	
	7		Dark brown 7.5 YR4/4 and reddish brown 5Y4/3	
	8	53	Brown 10YR5/3 and dark brown 7.5YR4/4	Red 2.5YR4/8 Yellow 2.5Y7/8 Turquoise? White Black
	9		Brown 7.5YR5/2 and dark brown 7.5YR4/4	
	10		Pinkish gray 7.5YR6/2 and light gray 10YR7/2	
	11		White	
	12		White	
	13		Grayish brown 2.5Y5/2 and light grayish brown 2.5Y6/2	
	14		Brown 10YR5/3	
	15		Dark grayish brown 10YR4/2 and olive gray 5Y4/2	
	16		Dark grayish brown 10YR4/2 and dark brown 10YR4/3 and 10YR4/4; backing—light gray 10YR7/2 and pinkish gray 7.5YR7/2	
	17		Reddish brown 5YR4/4 and dark brown 10YR4/3	
	18			Red 10R4/8 and 5/8 White
	Liner		Light gray 2.5Y7/2 and 5Y7/2 and light gray-gray 5Y6/1	Black
205	1		Brown-dark brown 7.5YR4/2 and 10YR4/3 and dark yellowish brown 10YR4/4	
	2		Reddish brown 2.5YR5/4 and 5YR5/3 and weak red 2.5YR4/2, 5/2	
	3		Brown 7.5YR5/4 and 10YR5/3, dark yellowish brown 10YR4/4, and yellowish brown 10YR5/4	
	4		White; backing—light gray 2.5Y7/2 and light brownish gray 10YR6/2	
	5		Brown 7.5YR5/2, 5/4 and 10YR5/3	
	6		White	
	7	54	Brown 10YR5/3, dark grayish brown 10YR4/2, and yellowish brown 10YR5/4	White Black
	8	42f	White; backing—pinkish gray 2.5YR7/2 and 7.5YR7/2 and light gray 10YR7/2	Black
	9		Pinkish gray 7.5YR6/2 and light gray 10YR7/2	
	10		Grayish brown 10YR5/4, dark yellowish brown 10YR4/4, dark brown 7.5YR4/4, and brown 7.5YR5/4	
	Liner		?	
220	1		White	Red 7.5R5/8 Black
	2		(or paint) 7.5R5/8 red	
	3		Reddish brown 5YR5/3	
	4		Yellowish brown 10YR5/6	White
	5		White	
43	?	42e	(Black ?) See layer description	White

*Based on the Rock Color Chart (The Geological Society of America, 1963) and the Munsell Soil Color Charts (Munsell Color Co., Inc., 1954).

Table 12.
Linear dots.

Provenience	Figure	Color	Immediate Associations
Kiva N, Layer 3, NE		White	
Kiva N, Layer 3, S		White	Bands
Kiva N, Layer 6, S	25	Black	Bands
Kiva N, Layer 6, SW	26	White	Bands, geometric miscellaneous, anthropomorph, unknown
Kiva N, Layer 7, NW	28	White	Geometric miscellaneous, zoomorph
Kiva N, Layer 7, NE		Red, black, white	Geometric miscellaneous, unknown
Kiva N, Layer 8, SW	44	White	Vertical lines, appendages, geometric miscellaneous, unknown
Kiva N, Layer 12, SE	30	White	Zoomorph, unknown
Kiva N, Layer 14, SW		Red	Vertical line
Kiva N, Layer 16, S		White	Bands, geometric miscellaneous
Kiva N, Layer 1, S		White	Bands
Kiva N, Layer 1, W		Yellow	
Kiva N, Layer 3, W		White	
Kiva N, Layer 4, W		White	
Kiva N, Layer 9, S		Red	
Kiva N, Layer 22, E		Yellow	
Room 12, Layer 8 or 9, W		White	
Room 12, Layer 23, N		White	
Room 43, Layer ?, N		White	

Table 14.
Linear dots, with and without vertical lines, with closely related forms.

Provenience	Figure	Color	Immediate Associations
Kiva N, Layer 3, SW	22	White	Appendages, geometric miscellaneous, botanical
Kiva N, Layer 1, SW	21	White	Bands, zoomorph, botanical
Kiva N, Layer 6, NW	24	White	Bands, gometric miscellaneous
Room 12, Layer 3, W	44	White	Appendages, anthropomorph
Room 12, Layer 6, W	45	White	Appendages
Room 12, Layer 11, W	46	White, black	Appendages
Room 12, Layer 14, W	47	White	
Room 12, Layer 21, W	48	White, red	Appendages
Room 12, Layer 23, W	49	White	Appendages
Room 12, Layer 26, W	51	White, black	Miscellaneous
Room 205, Layer 7, S	54	White, black	Appendages, geometric miscellaneous

Table 13.
Linear dots and vertical lines.

Provenience	Figure	Color	Immediate Associations
Kiva N, Layer 1, N		White	Bands
Kiva N, Layer 1, NE		White	Bands
Kiva N, Layer 7, N		White	
Kiva N, Layer 8, SW		White	Dots, appendages, geometric miscellaneous, unknown
Kiva N, Layer 13, SE	31	White	Geometric miscellaneous
Kiva N, Layer 14, SW		White	Dots
Kiva N, Layer 15, SW		White	
Room 12, Layer 1, W		White	
Room 12, Layer 15, W	47	White	Anthropomorph
Room 12, Layer 25, W	50	White	Geometric miscellaneous
Room 12, Layer 26, N		White	
Room 12, Layer 23, W		White	
Room 12, Layer ?, N, E		White	
Room 12, Layer ?, N, E		White	
Room 12, Layer ?, N, E		White	
Room 12, Layer ?, N, E		White	
Room 12, Layer ?, E		White	
Room 12, Layer ?, E		White	
Room 12, Layer ?, E		White	
Room 43, Layer 11?, N?		White	
Room 119, Layer 6, W		White	
Room 148, Layer 9, S, W		White	

Table 15.
Linear dots with appendages.

Provenience	Figure	Color	Immediate Associations
Kiva N, Layer 3, SW	22	White	Related forms, geometric miscellaneous, botanical
Kiva N, Layer 8, SW		White	Dot, vertical lines, geometric miscellaneous, unknown
Room 12, Layer 3, W	44	White	Related forms, anthropomorph
Room 12, Layer 6, W	45	White	Related forms
Room 12, Layer 11, W	46	White, black	Related forms
Room 12, Layer 21, W	48	White	Related forms
Room 12, Layer 23, W	49	White	Related forms
Room 205, Layer 7, S	54	White, black	Related forms, geometric miscellaneous

Table 16.
Bands.

Provenience	Figure	Color	Immediate Associations
Kiva N, Layer 1, NW	20	Black	Geometric miscellaneous, zoomorph, unknown
Kiva N, Layer 1, N		Black	Geometric miscellaneous
Kiva N, Layer 1, N		Black	Vertical lines
Kiva N, Layer 1, NE		Black	Vertical lines
Kiva N, Layer 1, SW	21	Black	Related forms, zoomorph, botanical
Kiva N, Layer 3, S		Red, yellow	Dots
Kiva N, Layer 6, NW–N	24	Red, yellow, black	Related forms, geometric miscellaneous
Kiva N, Layer 6, S	25	Red, yellow, black	Dots
Kiva N, Layer 6, SW	26	Red, yellow, black, white	Dots, geometric miscellaneous, anthropomorph, unknown
Kiva N, Layer 6, W	27	Red, yellow, black	Geometric miscellaneous
Kiva N, Layer 16, NW	32	Red, yellow, white, brown	Unknown
Kiva N, Layer 16, N	32	Red, yellow, white, brown	Geometric miscellaneous, unknown
Kiva N, Layer 16, N–NE	32	Red, yellow, white, brown	Geometric miscellaneous, anthropomorph, unknown
Kiva N, Layer 16, SE	33	Red, yellow, black, white	Geometric miscellaneous, realistic miscellaneous, unknown
Kiva N, Layer 16, S	34	Red, yellow, black, white, gray	Dots, geometric miscellaneous
Kiva N, Layer 16, SW	35	Red, yellow, white, black	Geometric miscellaneous
Kiva N, Layer 30, E	41	Red	Geometric miscellaneous
Kiva N, Layer 1, S		Black	Dots
Kiva N, Layer 21, SW		Black	
Kiva N, Layer 27, NW–N		White	
Kiva N, Layer 31, NE–E		Yellow	
Room 12, Layer 19, W		Splattered white	

Table 17.
Geometric miscellaneous.

Identifications	Provenience	Figure	Color	Immediate Associations
Five spots	Kiva N, Layer 1, NW	20	White	Bands, zoomorphs, unknown
Dots and slash line	Kiva N, Layer 1, N		Red	Bands
Enclosure	Kiva N, Layer 3, SW		Red, white	Related forms, appendages, botanical
Zigzag	Kiva N, Layer 5, SW		Red	
Circle and triangle	Kiva N, Layer 6, NW	24	Red, yellow, black	Related forms,
Unidentified	Kiva N, Layer 6, N		Red, yellow, black	Bands, unknown
Unidentified	Kiva N, Layer 6, NE-E	23	Red, yellow, black, orange, white	Unknown
Triangle, circle, and unidentified	Kiva N, Layer 6, SW	26	Red, yellow, white	Dots, bands, anthropomorph, unknown
Unidentified	Kiva N, Layer 6, W	27	Black	Bands
Enclosure, lightning, and unidentified	Kiva N, Layer 7, NW	28	Red, black and white	Dots, zoomorph
Unidentified	Kiva N, Layer 7, NE		Yellow, black and white	Dots, unknown
Circle	Kiva N, Layer 13, SE	31	White	Dots, vertical lines
Unidentified	Kiva N, Layer 16, N	15	Red, yellow, black and white	Bands, unknown
Unidentified, dot, square and slash	Kiva N, Layer 16, N–NE	32	Red, yellow, white	Bands, anthropomorph, unknown
Unidentified	Kiva N, Layer 16, SE	33	Red, black	Bands, realistic miscellaneous, unknown
Cone terrace	Kiva N, Layer 16, S	34	Red, yellow	Dots, bands
Triangle	Kiva N, Layer 16, SW	35	Red, white	Bands
Unidentified	Kiva N, Layer 16, W	36	Yellow, black and white	
Arch and miscellaneous	Kiva N, Layer 24, E	40	Red, yellow, gray	
Arch and line	Kiva N, Layer 28, N		Black	
Unidentified	Kiva N, Layer 30, E	41	Multi	Bands
"8"	Kiva N, Layer 8, SW		Yellow	Dots, vertical lines, appendages, unknown
Line	Kiva N, Layer 5, W		Red	
Unidentified	Kiva L, over ventilator	42b	Red, black, orange, gray	
Terraces	Room 12, Layer 25, W	50	White	Vertical lines
Unidentified	Room 12, Layer 29, N		White and red, black, brown	
Unidentified, terraces	Room 12, Layer ?, E	43	Red, black, white	
Arrow	Room 12, Layer 16, W	42c	Black	
Unidentified	Room 12, Layer 31, W	42d	White	
Lightning	Room 43, Layer ?	42e	White	
Unidentified	Room 168, Layer 18, N		Red, black	
Arch, line	Room 202, Layer 8, W	42f	Black	
Enclosure	Room 205, Layer 7, S	54	White	Related forms, appendages
Lines	Room 220, Layer 4, ?		White	

Table 18.
Pictorial motifs.

Identifications	Provenience	Figure	Color	Immediate Associations
Anthropomorphs				
Shield figure	Kiva N, Layer 6, SW	26	Red, yellow, black, white	Dots, bands, geometric miscellaneous, unknown
Lower portion only	Kiva N, Layer 16, N-NE	32	Red, yellow, black, white	Bands, geometric miscellaneous, unknown
Aberrant	Room 12, Layer 3, W	44	White	Related forms, appendages
Realistic dancers	Room 12, Layer 15, W	47	Multi	Vertical lines
Destroyed	Room 12, Layer 4, W		Red, black, white	?
Conventionalized dancers	Room 119, Layer 4, W	52	Red, yellow, black, white	Pictorial miscellaneous, unknown
Two incomplete	Room 168, Layer 8, N	53	Red, yellow, black, white, turquoise	
Legs only	Room 168, Layer 18, N		White	
Miscellaneous Pictorial Items				
Mask	Kiva N, Layer 11, E	29	Red, yellow, black, turquoise	Unknown
Medicine bundle?	Kiva N, Layer 16, SE	33	Red, yellow, black	Bands, geometric miscellaneous, unknown
Kilt	Kiva N, Layer 17, E	37	Red, yellow, black and turquoise	
Quiver, shield	Kiva N, Layer 18, NE-E	38	Multi	Unknown
Kilt	Room 119, Layer 14, W		Red	Anthropomorph, unknown
Zoomorphs				
Buffalo or bighorn	Kiva N, Layer 1, NW	20	Black	Bands, geometric miscellaneous, unknown
Pronghorn	Kiva N, Layer 1, SW	21	White	Related forms, bands, botanical
Birds	Kiva N, Layer 7, NW	28	White and red, yellow, black, brown	Dots, geometric miscellaneous
Bird	Kiva N, Layer 12, SE	30	Red, yellow, black	Dots, unknown
Botanical				
Corn	Kiva N, Layer 1, SW	21	White	Related forms, bands zoomorph
Corn ?	Kiva N, Layer 3, SW	22	White	Related forms, appendages, geometric miscellaneous

Table 19.
Unidentified elements.

Provenience	Figure	Color	Immediate Associations
Kiva N, Layer 1, NW	20	White	Bands, geometric miscellaneous, zoomorphs
Kiva N, Layer 6, N		Red, yellow, black	Bands, geometric miscellaneous
Kiva N, Layer 6, NE-E	24	Red, yellow	Geometric miscellaneous
Kiva N, Layer 6, SW	26	Red, yellow	Dots, bands, geometric miscellaneous, anthropomorph
Kiva N, Layer 7, NE		Red, yellow, black	Geometric miscellaneous
Kiva N, Layer 11, E		Red, yellow, black	Realistic miscellaneous
Kiva N, Layer 12, SE	30	Red, yellow	Dots, zoomorphs
Kiva N, Layer 16, NW	32	Red, black, white	Bands
Kiva N, Layer 16, N	32	Red, black, white	Bands, geometric miscellaneous
Kiva N, Layer 16, N-NE	32	Red, white	Bands, geometric miscellaneous, anthropomorph
Kiva N, Layer 16, SE	33	Red, yellow, black	Bands, geometric miscellaneous, realistic miscellaneous
Kiva N, Layer 18, NE-E	38	Multi	Realistic miscellaneous
Kiva N, Layer 21, E	39	Red, yellow	
Kiva N, Layer 8, W		Yellow, white	Dots, vertical line, appendages, geometric miscellaneous
Kiva N, Layer 9, W		Black	
Kiva N, Layer 25, NW-N, SW		Red	
Kiva N, Layer 25, E		Yellow, black	
Room 12, Layer 12, W		Red, black, white	
Room 119, Layer 4, W	52	Red	Anthropomorph, realistic miscellaneous
Kiva K	42a	White	
Room 220, Layer 1, ?		Red, black	
Room 220, Layer 2, ?		Red	

Table 20.
Percentage distribution of worked shell occurrences, by phase.

Species	Early Phase Percentage	Middle Phase Percentage	Late Phase Percentage	Total Occurrences —Percentage	
Mollusca sp.	33.33	16.67	9.45		9.67
Gastropoda sp.			5.67		4.30
Vermetidae sp.	–	–	1.89		1.07
Nassarius cf. *N. iodes*	–	–	1.89		1.07
Olivella sp.	–	16.67	16.98	12.89	28.99
O. dama	33.33	–	7.56	11.81	"
O. gracilis	–	16.67	1.89	3.22	"
O. anazora	–	16.67	–	1.07	"
Conus sp.	–	16.67	5.67	7.52	"
C. gladiator	–	–	1.89		1.07
Pelecypoda sp.	–	–	20.79		19.33
Arca sp.	–	–	3.77		2.15
A. multicostata	–	–	–		1.07
Glycymeris maculta	33.33	–	1.89		3.22
Pinctada sp.	–	–	1.89		2.15
Pinctada mazatlanica	–	–	1.89		1.07
Chama sp.	–	–	1.89		1.07
Unio sp.	–	16.67	9.45	12.89	16.11
U. *houstonensis*	–	–	1.89	1.07	"
Lampsilis sp.	–	–	3.77	2.15	"
Units of Use	**3**	**6**	**53**		93

Table 21.
Percentage composition of the worked bird bone collection.

Species	Early Phase Percentage	Middle Phase Percentage	Late Phase Percentage	Total Worked—Percentage	Total MFC Unworked—Percentage
Whistling Swan	–	7.69	T	T	–
Canada Goose	–	–	1.36	T	T
Mallard / Mexican Duck	20.00	–	T	T	T
Turkey Vulture	–	–	T	T	T
Buteonine Hawks	20.00	53.83	34.68	34.31	33.78
Golden Eagle	40.00	15.39	36.04	36.19	8.62
Bald Eagle	–	–	1.36	1.88	T
Osprey	–	–	T	T	–
Prairie Falcon	–	–	T	T	2.55
Common Turkey	20.00	15.38	12.92	12.69	41.08
Sandhill Crane	–	–	6.80	6.58	1.10
Great Horned Owl	–	7.69	2.04	1.88	T
Common Raven	–	–	1.36	1.41	3.43
Total hawks and eagles	60.00	69.22	73.44	75.74	
Total turkey	20.00	15.38	12.92	12.69	
Number of specimens	5	13	147	211	

Table 22.
Unworked bird bone.

	Mound 7						
Species	Early Phase Percentage	Middle Phase Percentage	Late Phase Percentage	Total MFC –Percentage	House A	San Buenaventura	Pueblo Pardo
Unknown bird				T			
Eared Grebe				T			
White Pelican				T			
Canada Goose			T	T			4.47
White-fronted Goose			T	T			
Snow Goose	2.22	T	T	T			
Mallard/Mexican Duck			T	T			
Pintail		T	T	T			
Green-winged Teal				T			1.49
Cinnamon Teal				T			
American Widgeon				T			
Unknown Diving Duck							1.49
Common Goldeneye				T			
Turkey Vulture		1.20	T	T			
Unknown hawk	1.11		T	T			
Goshawk				T			
Sharp-shinned Hawk		T		T			
Cooper's Hawk			1.11	T			
Buteonine hawk, general	2.22	1.81	2.59	2.02		6.34	
Red-tailed Hawk	10.00	10.84	12.10	11.84	23.10	15.49	7.45
Swainson's Hawk	6.67	10.23	5.83	5.67	3.85	4.23	5.96
Rough-legged Hawk			1.19	1.01		2.11	
Ferruginous Hawk	11.11	10.84	13.18	13.24	15.40	14.93	16.20
Golden Eagle	10.00	7.22	8.75	8.62	7.70	10.56	10.43
Bald Eagle			T	T			
Marsh Hawk		1.20	T	T			
Prairie Falcon	2.22	1.81	1.84	2.55	3.85	4.93	1.49
Peregrine Falcon	1.11		T	T			
Pigeon Hawk	2.22		T	T	T	T	T
Sparrow Hawk	2.22	3.61	2.59	2.29			2.98

Table 22.
Continued.

	Mound 7						
Species	Early Phase Percentage	Middle Phase Percentage	Late Phase Percentage	Total MFC –Percentage	House A	San Buenaventura	Pueblo Pardo
Quail, general			T	T	T	T	T
Scaled Quail		1.81	T	T			1.49
Harlequin Quail			T	T			
Domestic Chicken			T	T	3.85	T	
Common Turkey	35.56	42.74	39.74	41.08	34.65	35.92	37.25
Sandhill Crane, general			T	T			
Lesser Sandhill Crane		1.20	T	T	3.85		
Greater Sandhill Crane	1.11	T	T	T			
American Coot	1.11			T			
Long-billed Curlew							1.49
Mourning Dove			T	T			
Scarlet Macaw			T	T			
Roadrunner		1.20	T	T	T	T	T
Great Horned Owl	2.22		T	T		T	
Burrowing Owl	1.11			T			2.96
Long-eared Owl			T	T			
Short-eared Owl				T			
Common Nighthawk	1.11			T			
Horned Lark		T	T	T			T
Purple Martin			T	T			
Common Raven	5.56	1.20	4.21	3.45		1.41	4.47
White-necked Raven				T			
Common crow	1.11		T	T		T	
Pinyon Jay				T			
Canyon Wren				T			
Thrush, unknown						T	
Meadowlark, unknown			T	T			
House Finch				T			
Sparrow, unknown			T	T			
Number of specimens	90	166	924	2,298	26	142	67

Table 23.
Age groupings of mound 7 turkeys, by phase.

Age	Early Phase Percentage	Middle Phase Percentage	Late Phase Percentage	Total Collection –Percentage
Old Adult	1.6	3.0	3.4	3.6
Adult	63.3	64.5	64.6	62.5
Young Adult	1.6	4.5	4.9	4.4
Immatures	18.3	10.0	13.7	16.9
Juveniles	14.8	18.0	13.4	12.5

Table 24.
Fractures in mound 7 turkeys.

Element Fractured	Healed with Malunion	Healed with Nonunion
Humerus	3	4
Coracoid	3	
Scapula	1	
Radius	1	
Tibiotarsus	1	
Tarsometatarsus	1	
Pedal phalanx	1	

Table 25.
Distribution of feather colors.

Feather Color	Minimum Faunal Count	Percentage of the Collection
Brown- and white-banded	1,145	50.38
Irridescent (turkey)	944	41.08
Black	94	4.13
Gray	25	1.10
Red	2	.09
Blue	2	.09
Totals	2,212	96.87

Table 26.
Percentage of minimum faunal count from dated samples.

Species	Early Phase	Middle Phase	Late Phase
Rabbit	16.83	10.38	14.53
Jackrabbit	17.56	16.74	13.68
Mule Deer	5.61	9.16	4.27
White-tailed Deer	1.61	1.09	2.56
Pronghorn	45.90	49.18	29.06
American Bison	4.59	9.16	4.27
All others	7.98	4.29	16.30
Introduced domestic animals			15.33
Minimum faunal count	196	183	117

Table 27.
Percentage of meat produced.

Species	Early Phase	Middle Phase	Late Phase
Mule Deer	8.94	9.72	4.71
White-tailed Deer	1.83	0.97	2.13
Pronghorn	40.21	32.11	17.60
American Bison	47.52	54.81	30.57
All others	1.50	2.39	1.28
Total wild mammals	100.00	100.00	56.29
Total domestic mammals			43.71
Total mammals			100.00

Table 28.
Comparison of worked and unworked mammal bone.

Species	Early Phase Percentage, Worked	Middle Phase Percentage, Worked	Late Phase Percentage, Worked	Total Percentage Worked	Total MFC Percentage Worked
Unknown mammal	8.00	3.33	2.55	3.73	T
Man				T	*
Rabbit				T	13.84
Jackrabbit			10.20	5.09	18.19
Unknown carnivore				T	
Wolf or dog		3.33	1.53	1.23	T
Wolf			1.53	T	T
Domestic dog			T	T	T
Coyote		3.33	4.08	2.99	T
Kit fox			T	T	T
Bear, general				T	T
Black Bear				T	T
Mountain Lion			1.53	T	
Bobcat	4.00	3.33	3.57	2.28	T
Horse			1.53	T	T
Unknown artiodactyl	32.00	19.98	9.69	13.88	2.18
Deer or elk		3.33		T	
Deer, general (antler only)	4.00	3.33	8.16	6.68	T
Mule Deer	4.00	3.33	11.73	14.24	5.32
White-tailed Deer		3.33	T	T	2.88
Pronghorn	36.00	9.99	15.30	19.61	35.87
American Bison	12.00	43.29	26.01	26.01	7.11
Total carnivore	4.00	9.99	14.28	9.14	
Total artiodactyl	188.00	86.58	71.40	81.02	
Sample size	25	30	196	569	1,561

*See Part 7, by Erik K. Reed.

Table 29.
Osteometric data from Mound 7 dogs.
Note: all measurements in mm.

Measurement	Specimen No. 3269	Specimen No. 296	Specimen No. 10,169
Cranium			
Occipital length	152.9		
Palatal length	76.7		
Width of palate at M^1	45.7		
Width at canines	27.1		
Width of zygomatic arch	ca. 75.6		
Nasal length	54.1		
Occiput to nasion	82.5		
Orbit to alveolus I^1	65.4		
Supraorbital width	41.2		
Interorbital width	30.3		
Cranial height	52.3		
Max. cranial width	54.6		
Meatus to alveolus I^1	119.6		
Alveolus I^1 to M^2	76.7		
Alveolus canine to M^2	62.9		
Alveolus P^1 to M^2	49.8		
Alveolus P^2 to M^2	44.1		
Alveolus M^1 to M^2	15.5		
Length carnassial P^4	15.5		
Mandible			
Alveolus I_1 to M_3	77.4		
Alveolus canine to M_3	71.3		
Alveolus P_1 to M_3	58.4		
Alveolus P_2 to M_1	54.4		
Alveolus P_3 to M_3	48.2		
Alveolus P_4 to M_3	39.9		
Alveolus M_1 to M_3	31.9		
P_1 to P_4	28.1		
Length carnassial M_1	19.9		
Condylo-symphysis length	105.7		
Bicondylar width	68.9+		
Humerus			
Length	108.3		
Diameter of head	28.7		
Transverse diameter of head	21.6		
Radius			
Length	113.0		
Ulna			
Length	136.6		
Notch	17.0		
Femur			
Length	125.0	132.0	
Tibia			
Length	121.3		130.1
Baculum			
Length	70.5		
Width	8.2		

Source: After Haag, 1948, pp. 111-118.

Table 30.
Age classifications of Mound 7 aged pronghorns.

Specimens	Minimum Faunal Count	Percentage
Fawn under 2 weeks	3	T
Young immatures		
Large immatures, ca. 18 months	153	27.36
Young adults, ca. 2 years	81	14.48
Adults, predominantly 3, some 4 years old	321	57.39
Old adults, 5 years or older	1	T

Table 31.
Tempering materials used in Pueblo IV pottery in the Rio Grande area.

		Glazes									
Temper Categories		Early Glaze	Agua Fria G/p	San Clemente G/p	Cieneguilla G/y, G/p	Largo G/y G/p, G/r	Pottery Mound G/p	Espinosa G/p	San Lazaro G/p	Puarai G/p (late)	Kotyiti G/r, G/p G/y
I.	Vesicular basalt	14.0	33.0	48.5	14.8	16.6	60.0	3.6	1.4		0.9
	San Felipe basalt		3.1								
	Zia(?) basalt								1.4	1.5	0.9
	Misc. basalt	1.1		19.5			20.0		2.8		
II.	Sherd, white-buff	37.6		3.2	3.7					1.5	
	Sherd, red-orange	24.8	17.6								
	Sherd, misc.	12.9	16.3	9.7	7.4			1.2	8.5		
III.	Biotite Felsite	1.1	3.1			4.2*			2.8	4.6	1.9
	Hornblende syenite	2.1	4.1					29.0	45.1	50.7	29.2
	San Marcos latite		6.2	3.2	3.7	12.5		7.2			
	Augite latite		4.1		44.5	54.1		8.4			
	Intermediate igneous		2.1		3.7			1.2		4.6	
IV.	Tonque latite		1.0	0.4	3.7	4.2		37.4	25.4	9.3	
	Hornblende latite				7.4	4.2		1.2		1.5	
	Sandy Hornblende latite								2.8	3.1	9.4
V.	Rhyolite tuff								1.4	9.3	1.9
	Metarhyolite(?)	3.0	4.1								
	Crystal vitrophyre		3.1			4.2*	20.0	3.6	7.0	3.1	
	Glassy scoria	1.1	1.0	3.2							
VI.	Calcite, shale										
	Pecos sandstone							3.6			1.9
	Misc. sandstone										
VII.	Hornblende gneiss							1.2		9.3	52.0
	Quartz-mica schists				3.7						
	Quartzite(?)										
	Unidentified	2.1	1.0	6.4	7.4			2.4	1.4	1.5	1.9
Number sherds examined		93	97	14	27	24	5	83	71	65	106

Table 31.
Continued.

		Black-on-white			Utility			
Temper Categories		Chupadero B/w	Transitional Chupadero-Tabira	Tabira B/w	Corona Corrugated	Corona Plain	Salinas Red	Probable Area of Manufacture
I.	Vesicular basalt						1.2	Pottery Mound; Los Lunas
	San Felipe basalt							San Felipe area
	Zia(?) basalt							Zia villages (?)
	Misc. basalt							Various
II.	Sherd, white-buff							Acoma-Zuni
	Sherd, red-orange							Lower Middle Rio Grande
	Sherd, misc.						2.3	Various
III.	Biotite Felsite		63.6	95.0	10.3	74.3	34.1	Gran Quivira
	Hornblende syenite						31.8	Abo Pueblo (Tompiro villages)
	San Marcos latite							San Marcos Pueblo, Galisteo
	Augite latite							Galisteo Basin
	Intermediate igneous						1.2	Galisteo Basin (?)
IV.	Tonque latite							Tonque Pueblo and Valley
	Hornblende latite							Galisteo Basin; San Felipe
	Sandy Hornblende latite							Galisteo Basin
V.	Rhyolite tuff							Cochiti-Pajarito Plateau
	Metarhyoliter(?)							Lower Middle Rio Grande (?)
	Crystal vitrophyre					1.1	3.5	Various
	Glassy scoria							Unknown
VI.	Calcite, shale	91.3	36.4	3.6	3.3			Gran Quivira
	Pecos sandstone							Pecos Pueblo
	Misc. sandstone						2.3	Unknown; prob. E. Tiwa Dist.
VII.	Hornblende gneiss					1.1	22.4	Quarai or E. Tiwa
	Quartz-mica schists	8.7			58.6	3.4	1.2	Gran Quivira area (?)
	Quartzite(?)				24.5	20.1		Gran Quivira area (?)
	Unidentified			1.4	3.3			
Number of sherds examined		113	11	219	29	89	85	

Table 32.
Age classes of inhumation burials.

	Totals
Neonate, fetal, or premature: #10, 13, 27, 32, 49, 51b, 75, 80, 85, 138, 159, 160, 167, 170, 188, 190, 191, 194, 201, 218, 221, 224, 250, 263, 266, 296, 304, 306, 319, 334, 388, 408, 439, 464, 467, 470, 473, 479, 496, 500	40
In the first year of life: #5, 8, 9, 94, 95, 98, 103, 107, 108, 110, 137, 199, 225, 245, 279, 314, 368, 422, 434, 442, 443, 449, 451, 459	24
From 1 to 4 years old: #1, 2, 6, 12, 33, 39, 42, 43, 55, 66, 68, 72, 74, 78, 81, 82, 83, 93, 96, 97, 101, 102, 113, 114, 115, 117, 124, 127, 128, 130, 131, 133, 139, 141, 144, 147, 153, 164, 172, 179, 180, 181, 195, 209, 226, 231, 236, 246, 249, 251, 252, 255, 258, 278, 286, 297, 301, 303, 305, 312, 315, 317, 318, 335, 338, 342, 367, 376, 379, 385, 395, 414, 432, 435, 436, 438, 440, 455, 456, 463, 465, 471, 474, 478, 480, 481, 482, 483, 494, 498, 502, 507	93
	157
Between 4 and 18 years:	
4 to 7 years: #19b, 20, 86, 91, 104, 105, 125, 132, 134, 173, 174, 177, 200, 227, 290, 313, 316, 378, 382, 392, 399, 402, 457, 489, 490, 492	26
8 or 9 years: #15, 19, 25, 146, 216, 274, 284, 403, 493	9
About 9 to 12 years: #151, 257, 261, 268, 277, 283, 287, 340, 343, 485, 510	11
13 to 15 years: #44, 77, 171, 211, 487	5
16 to 18 years: #271, 276, 390, 486	4
	55
	Totals
Sub-adults (18 or 19 to 21): #3, 14, 169, 213, 214, 270, 400, 450, 452, 458	10
Youthful adults (early and middle 20's): #50, 71, 118, 165, 193, 196, 235, 240, 243, 248, 254, 273, 275, 295, 320, 339, 383, 394, 404, 417, 418, 428, 468	23
Mature adults (about 27 to about 35 to 38): #61, 62, 65, 87, 120, 149, 152, 158, 163, 176, 198, 208, 210, 262, 272, 281, 282, 285, 288, 289, 291, 302, 325, 337, 344, 355, 381, 392, 407, 419, 437, 444, 445, 460, 462, 466, 477, 491, 497, 509	41
Adults of about 35 to about 42: #4, 17, 21, 26, 56, 57, 59, 76, 112, 119, 121, 136, 145, 161, 175, 207, 217, 237, 256, 265, 341, 389, 401	23
Adults 42 to 50 or over: # 4, 41, 109, 126, 162, 202, 212, 247, 329, 409	10
Adults of indeterminate age:	*Total*
#7, 11, 16, 18, 51a, 79, 92, 111, 116, 122, 123, 129, 135, 140, 142, 143, 148, 150, 168, 204, 230, 238, 244, 264, 267, 292, 331, 332, 333, 336, 374, 375, 377, 380, 391, 406, 410, 441, 446, 454, 505, 508	42
	149
Total	361

Table 33.
Cranial measurements and indices, adult males.
Note: all measurements in mm. (Figures in parentheses are estimated).

	#14	#17	#21	#41	#59	#120	#121	#129	#149
Length of vault	(166)	195	187	165	–	171	175	174	173
Maximum breadth	151	141	140	(not less than 130)	–	147	140	(140)	136
Basion-bregma height	–	–	–	–	–	144	140	(136)	139
Cranial index	–	71.79	74.86	–	–	85.96	80.00	(80.46)	78.61
Mean height index	–	–	–	–	–	90.56	88.88	(89.17)	86.87
Min. frontal diam.	93	88	107	–	–	99	97	94	96
Max. bizygomatic diam.	–	–	(145)	(not less than 130)	–	140	140	142	143
Total face height	–	–	125	(126)	–	127	128	–	133
Upper face height	(70)	(70)	70	77	–	77	77	76	81
Facial index	–	–	(86.2?)	–	–	90.71	91.43	–	93.01
Upper face index	–	–	(48.3?)	–	–	51.43	51.43	53.52	56.64
Nasal height	(49)	(47)	50	(55)	54	54	53	52	55
Nasal breadth	–	(19?)	28	23	25	26	26	8	26
Nasal index	–	–	56.0	(40.9)	46.3	48.14	49.25	53.85	47.27
Orbit height, right	–	35	34	(26)	–	38	36	34	36
Orbit height, left	35	–	34	–	–	38	36	34	34
Dacryal breadth, right	–	39	37	38.5	–	40	41	40	40
Dacryal breadth, left	38	–	39	–	–	39	41	38	40
Mean orbital index	92.1 (left)	94.6 (right)	89.4	–	–	96.20	87.805	91.89	92.50
External palatal length	–	–	–	–	–	53	53	54	56
External palatal breadth	–	–	–	–	–	66	66	65	69
External palatal index	–	–	–	–	–	124.5	124.5	120.4	123.2
Mandibular length	–	100	–	–	102	108	106	–	101
Bicondylar width	–	109	–	–	(112)	123	120	–	127
Bigonial width	–	90	–	–	96	(106)	103	–	96
Height of symphysis	34	34	–	–	32	38	38	–	41

	#204	#207	#212	#217	#256	#260	#262	#281	#285
Length of vault	–	(167)	173	(186)	185	176	156	179	170
Maximum breadth	–	(near 145)	132	(128)	140	137	147	134	128
Basion-bregma height	–	–	(140??)	138	136	133	137	143	128
Cranial index	–	(86.83?)	76.30	(distortion)	75.69	77.84	94.02	74.86	75.29
Mean height index	–	–	–	(87.9?)	83.69	84.92	83.83	92.52	85.91
Min. frontal diam.	85	88	91	90	101	94	91	–	84
Max. bizygomatic diam.	–	–	(135?)	138	145.5	139	132	142	(128)
Total face height	–	122	–	112	130	129	125	125	–
Upper face height	71	71	(70?)	68	81	79	74	77	68
Facial index	–	–	–	81.16	89.34	92.09	94.69	88.03	–
Upper face index	–	–	–	49.27	55.67	56.83	56.06	54.23	(53.13?)
Nasal height	49	53	49	49	53	54	51	57	51
Nasal breadth	25	22	25	26	28	27	26	28	27
Nasal index	51.02	41.5	51.02	53.06	52.8	50.0	50.98	49.12	52.94
Orbit height, right	30	35	34	35	38	35	34	–	36
Orbit height, left	(31)	35	34	35	38	34	35	33	36
Dacryal breadth, right	–	40	39	38	42	39	38	–	38
Dacryal breadth, left	36	39	37	38	42	37	39	39	38
Mean orbital index	(83.3)	90.90	89.47	92.11	90.47	90.79	87.34	84.61	94.74
External palatal length	–	–	–	–	62	53	50	–	52
External palatal breadth	–	–	–	–	(71)	64	62	–	(60)
External palatal index	–	–	–	–	(114.5?)	120.75	124.0	–	(115.4?)
Mandibular length	–	110	106	–	(107?)	112	103	112	–
Bicondylar width	–	123	116	–	(117)	121	116	131.5	–
Bigonial width	–	100	94	108	89	106	88	94	–
Height of symphysis	–	35	(34?)	34	37	39	36	(38)	–

Table 33.
continued.

	#288	#292	#329	#333	#383	#391	#437	#458	#491
Length of vault	–	173	176	179		186	180	187	167
Maximum breadth	–	134	135	143		131	141	–	137
Basion-bregma height	–	140	134	141		142	140	139	132
Cranial index	–	77.57	76.70	79.84		70.4	77.8	–	82.04
Mean height inded	–	91.21	86.17	87.58		89.6	87.2	–	86.8
Min. frontal diam.	91	91	91	91	96	98	88	99	89
Max. bizygomatic diam.	–	128	(128)	146	(151?)	140	140	134	(146)
Total face height	–	(120?)	–	–	(125)	127	122	124	117
Upper face height	82	72	(75)	81	71	75	73	74	74
Facial index	–	–	–	–	–	90.7	91.04	(84.9)	86.7
Upper face index	–	56.25	–	55.48	–	53.6	54.5	(50.7)	54.8
Nasal height	(55)	51	53	58	51	49	50	52	50
Nasal breadth	(26)	26	27	26	25	22	26	28	26
Nasal index	(47.3?)	50.98	50.94	44.8	49.2	44.9	52.0	53.85	52.0
Orbit height, right	–	35	35	37	(36?)	35	35	37	34
Orbit height, left	(36)	35	34	37	33	33	34	36	34
Dacryal breadth, right	–	38	40	42	(43?)	40	36	41	3
Dacryal breadth, left	(39)	40	40	40	40	39	35	41	37
Mean orbital index	–	89.74	86.25	90.24	82.5 (left)	86.1	97.2	89.02	90.7
External palatal length	–	–	–	59	56	53	52	56	54
External palatal breadth	–	–	–	71	71	68	65	71	66
External palatal index	–	–	–	120.34	126.8	128.3	125.0	126.8	122.2
Mandibular length	–	(104?)	–	–	(111)	108	106	–	102
Bicondylar width	–	–	–	–	126	124	117	–	118
Bigonial width	–	(104?)	–	–	100	102	97	93	100
Height of symphysis	40	(32+)	–	–	36	42	37	36	37

	#497	#508	Means	Number	Ranges	
					Deformed	Undeformed
Length of vault	(162)	(161)	176.35-(174.76)	20(25)	156-175	165-195
Maximum breadth	(154?)	–	138.55-(138.1)	18(20)	140-151	128-147
Basion-bregma height	–	–	137.87-(137.76)	16(17)	136-144	128-143
Cranial index	strongly deformed	–	78.21-(78.33)	17(18)	70.4-94.02	
Mean height index	–	–	87.55-(87.66)	14(15)	83.69-92.52	
Min. frontal diam.	94	95	93.12- –	26	84-107	
Max. bizygomatic diam.	(142?)	(140?)	138.89-(138.42)	14(18)	128-146	
Total face height	124	128	125.07-(125.12)	15(17)	112-133	
Upper face height	77	74	75.0-(74.63)	24(27)	68-82	
Facial index	–	–	89.9-(89.49)	11(12)	81.2-94.7	
Upper face index	–	–	54.27-(54.03)	14(15)	49.3-56.8	
Nasal height	54	49	52.04-(51.97)	25(29)	49-58	
Nasal breadth	27	27	26.0-(26.0)	26(27)	22(19?)-28	
Nasal index	50.0	55.1	50.28-(49.92)	25(26)	41.5-56.0	
Orbit height, right	37	36	35.26-(35.29)	23(24)	30-38	
Orbit height, left	35	35	34.87-(34.77)	24(26)	31-38	
Dacryal breadth, right	(39)	39	39.25-(39.24)	22(23)	36-42	
Dacryal breadth, left	41	38	38.84-(38.85)	25(26)	35-42	
Mean orbital index	90.0	92.2	90.13-(89.83)	22(23)	82.5-97.2	
External palatal length	56	56	54.69- –	16	50-62	
External palatal breadth	64	69	66.93-(66.75)	14(16)	62(61)-71	
External palatal index	114.3	123.2	123.16-	14	114.3-128.3	
Mandibular length	–	108	See Table 35			
Bicondylar width	–	125	See Table 35			
Bigonial width	103	97	See Table 35			
Height of symphysis	35	35	See Table 35			

Table 34.
Cranial measurements and indices, adult females.
Note: all measurements in mm.

	#34	#50	#56	#65	#76	#79	#163	#165	#169	#193	#202
Length of vault	(ca. 170?)	168	–	(164)	168	174	168	(168?)	166	(182)	174
Maximum breadth	(ca.135?)	130	–	(131)	134	136	135	(140?)	136	(135)	141
Basion-bregma height	–	–	–	130	131	142	(135)	–	127	(est. near 135)	–
Cranial index	–	77.38	–	(ca. 80?)	79.76	78.16	80.36	(83.3??)	81.93	–	81.034
Mean height index	–	–	–	(ca. 88?)	86.75	91.61	89.11	–	84.11	–	–
Min. frontal diam.	(ca. 95?)	88	–	86	91	89	91	87	92	88	(92)
Max. bizygomatic diam.	(ca. 130?)	not less than 125, near 127	(prob. ca. 120–125)	131	128	136	127	(123)	129	(128)	(131)
Facial height	(ca. 115?)	(115)	–	107	(118) [tooth loss but close]	115	114	116	114	(125?)	(111)
Upper face height	69	69	66	62	76	69	73	60	69	(76)	66
Facial index	–	–	–	81.7	(92.2)	84.6	89.76	(94.3)	88.37	–	–
Upper face index	–	–	–	47.3	59.4	50.7	57.48	48.8	53.49	(59.4?)	(50.4)
Nasal height	48	50	46	45	47	50	50	42	49	(54)	46
Nasal breadth	27	24	25	23	25	28	26	26	24.5	(27)	24
Nasal index	56.25	48.0	54.35	51.1	53.2	56.0	52.0	61.905	50.0	(50.0)	52.2
Orbit height, right	–	35	–	33	35.5	34	35	31.5	34.5	–	32
Orbit height, left	34.5	35	38	33	35.5	36	35	30.5	34.5	35	31
Dacryal breadth, right	(38)	38	–	37	38	35	38	37	37	–	(38)
Dacryal breadth, left	37	38	41	34	38	35	36	35	37	(38?)	(38)
Mean orbital index	(left, 93.24)	92.1	(left, 92.7)	92.95	93.4	100.0	94.59	86.11	93.24	–	(82.9)
External palatal length	–	–	–	–	–	–	–	–	50	–	–
External palatal breadth	–	–	–	–	–	–	–	–	61	–	–
External palatal index	–	–	–	–	–	–	–	–	122.0	–	–
Mandibular length	104	–	–	97	102	98	102	–	104	(104)	–
Bicondylar width	116	–	–	109	117	125	116	–	119	108	–
Bigonial width	103	–	–	92	94	98	94	86	89	99	80
Height of symphysis	34	34	–	32.5	37	34.5	31	35	35	39	34

	#208	#213	#214	#235	#237	#248	#267	#273	#282	#291	#295
Length of vault	171	167	–	(166)	–	176	–	163	153	169	165
Maximum breadth	(132)	132	–	(145?)	–	135	–	131	136	144	135
Basion-bregma height	(136?)	130	134	–	–	129	–	117	135	–	137
Cranial index	(77.2?)	79.04	–	–	–	77.27	–	80.37	88.89	85.21	81.81
Mean height index	–	86.96	–	–	–	82.96	–	79.59	93.08	–	91.33
Min. frontal diam	90	84	88	86	93	90	(88?)	82	95	92	86
Max. bizygomatic diam.	–	(2 × 65 = 130)	127	(140)	(135)	132	–	123	127	131	126
Facial height	–	115	106	126	106	111	–	(100?)	104	116	116
Upper face height	–	71	62	79	67	67	76	(61)	62	68	68
Facial index	–	(88.5)	83.54	(90.0?)	78.5?)	84.1	–	–	81.9	88.55	92.06
Upper face index	–	(54.6	48.8	(56.4?)	(49.6?)	50.75	–	(49.6)	48.8	51.9	53.97
Nasal height	–	50	47	54	47	50	48	44	46	51	47
Nasal breadth	–	25	26	23	26	24	26.5	25	25	25.5	23
Nasal index	–	50.0	53.3	42.6	55.3	48.0	55.2	56.8	54.35	50.0	48.9
Orbit height, right	–	–	32	38	34	34	34	31	33	34	34
Orbit height, left	–	36	32	36	34	34	35	30	32.5	35	33
Dacryal breadth, right	–	–	34	42	39	39	39	35	38	36	38
Dacryal breadth, left	–	36	36	40	37	37	37	33	37	(38)	38
Mean orbital index	–	(100.0)	91.43	90.24	89.5	89.5	90.8	92.65	87.3	97.24	88.16
External palatal length	–	–	(47?)	54	(52)	52	–	–	–	–	54
External palatal breadth	–	–	63.5	62	61	67	(60)	–	–	–	62
External palatal index	–	–	–	114.8	(117.3)	128.85	–	–	–	–	114.8
Mandibular length	–	–	95	(100)	–	(104)	–	98	92	104	104
Bicondylar width	–	–	113	–	–	120	–	98	113	119	115
Bigonial width	–	–	92	103	89	86	–	87	87	(93)	95
Height of symphysis	39	–	31	36	30.5	31	–	32	(29)	(31)	32

Table 34.
continued.

	#320	#325	#331	#389	#394	#401	#404	#410	#417	#418	#419
Length of vault	–	169	–	166	168	167	154*	168	(ca. 151?)	162	177
Maximum breadth	–	139	–	131	124	134	146*	–	(ca. 144?)	135	129
Basion-bregma height	–	–	–	135	(126)	136	139	–	(ca. 131?)	135	135
Cranial index	–	82.25	–	78.9	73.8	80.2	(94.8)*	–	–	"83.3"	72.9
Mean height index	–	–	–	90.9	(86.3)	90.4	92.7	–	–	90.9	88.2
Min. frontal diam.	–	97	88	92	88	90	94	87	91	98	99
Max. bizygomatic diam.	61 X 2 = 122)	132	(65 X 2 = 130)	132	126	127	134	(135)	(138)	132	128
Facial height	117	109	(115?)	110	112	–	112	117	117	113	118
Upper face height	67	67	(69)	(68?)	65	(68?)	69	71	69	66	69
Facial index	(95.9)	82.57	–	83.3	88.9	–	83.6	(86.7)	(84.7)	84.1	92.2
Upper face index	(54.9)	50.76	–	–	51.6	–	51.9	(52.6)	(50.0)	50.0	53.9
Nasal height	46	48	49	48	48	48	52	50	49	46	48
Nasal breadth	25	25	27	24.5	23	(27)	24	26	25	27	25
Nasal index	54.35	52.1	55.1	51.04	47.9	(56.25?)	46.2	52.0	51.02	58.7	52.1
Orbit height, right	33	34	38	37	–	37	36	35	35	34	34
Orbit height, left	–	33	–	36	34	38	36	34	35	33	32
Dacryal breadth, right	38	40	40	38	(37)	39	38	39	39	41	39
Dacryal breadth, left	–	38	–	38	36	39	38	37	39	41	38
Mean orbital index	(86.8)	85.9	(95.0)	96.05	94.4 (left)	96.15	94.7	90.8	89.74	82.7	85.7
External palatal length	(51)	(51)	–	–	51	(52?)	47	54	51	55	51
External palatal breadth	57	65	–	–	61	(63)	62	62	66	63	66
External palatal index	(111.96)	(127.45)	–	–	119.6	–	131.9	114.8	129.4	114.5	129.4
Mandibular length	101	(95)	92	96	100	–	98	98	(102)	102	100
Bicondylar width	115	(115)	106	121	(102)	–	122	128	–	123	118
Bigonial width	85	(92)	84	92	(91)	–	98	94	(94)	93	85
Height of symphysis	33	(31)	(30)	34	31	–	30	37	35	36	36

	#462	#466	#477	Means	Number	Ranges	
						Deformed	Undeformed
Length of vault	168	168	152*	167.95–(167.15)	22 (27)	152–169	167–177 (182)
Maximum breadth	–	141	135*	134.63–(134.88)	19 (24)	131–146	124–141
Basion-bregma height	122	–	139	132.53–(132.31)	17 (19)	117–137	122–142
Cranial index	–	83.9*	88.8*	79.96–(80.34)	17 (19)	80.4–88.9	72.9–82.25
Mean height index	–	–	96.9	89.03–(88.86)	15 (16)	84.1–96.9	79.6–91.6
Min. frontal diam.	87	90	(88?)	89.97–(90.03)	30 (31)		82–99
Max. bizygomatic diam.	128	(132)	127	129.15–(130.15)	20 (27)		123–136 (140)
Facial height	112	119	104	113.04–(113.21)	25 (28)		104 (100)–126
Upper face height	71	70	68	68.37–(68.39)	30 (33)		60–79
Facial index	87.5	(90.15)	81.9	85.8–(87.13)	17 (24)		81.7 (78.5)–92.2 (95.9)
Upper face index	55.5	(53.03)	53.7	52.15–(52.16)	18 (25)		47.3–59.4
Nasal height	50	51	49	48.21–(48.37)	34 (35)		42–54
Nasal breadth	25	23.5	23	25.26–(25.36)	33 (35)		23–28
Nasal index	50.0	46.1	46.9	51.91–(51.85)	33 (34)		42.6–61.9
Orbit height, right	35	35	37	34.45– –	30		31–38
Orbit height, left	34	35	36	34.28– –	33		30–38
Dacryal breadth, right	38	39	(37)	38.14–(38.06)	28 (32)		34–42
Dacryal breadth, left	38	(37)	37	37.27–(37.31)	29 (32)		33–41
Mean orbital index	90.8	92.1	98.6	91.67–(91.69)	28 (34)		85.9 (82.9)–100.0
External palatal length	53	49	44	51.15–(51.19)	13 (16)		47–55
External palatal breadth	66	61	59	62.68–(62.55)	17 (19)		57–67
External palatal index	124.5	126.5	134.1	123.47–(122.61)	13 (16)		114.5–134.1
Mandibular length	94	–	98	See Table 35			
Bicondylar width	112	-	115	See Table 35			
Bigonial width	94	–	92	See Table 35			
Height of symphysis	34	33	29	See Table 35			

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*Strongly deformed.

Table 35.
Measurements of additional mandibles.
Note: all measurements in mm.

Males	Mandibular Length	Bicondylar Diameter	Bigonial Width	Height of Symphysis
# 21	110	124	109	38
# 41	(100)	(125?)	102	34
#109	116	129	98	38
#119	102	129	111	(33)
#229	102	110	90	38
#265	116	129	102	38
#270	102	112	(91)	32
#446	112	136	(112)	40
Additional symphysial heights: 33, 35, 37, and (#16) 41				
Means (including those from Table 33)	106.9 (106.7)	122.2 (121.5)	98.7 (99.15)	36.7 (36.6)
Number	21 (23)	21 (23)	24 (27)	30 (32)
Ranges	100–116	109–136	88–111	32–42
Females				
# 71	–	–	–	31
#158	114	118	101	37
#168	108	123	107	37
#175	100	(122)	89	(31?)
#243	106	114	88	34
#302	(99)	(122)	(97)	33.5
#445	102	119	99	38
#454	104	112	99	34
Means (including those from Table 34)	100.5 (100.5)	116.1 (115.97)	92.7 (92.8)	34.0 (33.6)
Number	27 (33)	27 (31)	31 (36)	35 (39)
Ranges	92–114	98–125	80–107	30–39

Table 36.
Long bones, adult males. Note: All measurements in mm. unless otherwise noted.

		#11	#14	#16	#17	#18	#21/22	#26	#41	#59
Length of clavicle,	right	–	(137?)	157	–	150	151	148	–	158
	left	–	–	–	155	–	–	–	152	150
Diameter of head of humerus,	right	45	44	45	44	45	46	–	43.5	47
	left	–	43	–	–	–	46	–	43.5	47
Length of humerus (bicondylar),	right	304	298	310	–	(ca. 290)	(pathol.)	(ca. 300)	295	298
	left	–	303	–	300	–	316	–	297	298
Length of radius,	right	242	–	–	–	238	246	245	232	238
	left	–	244	–	244	–	246	–	–	–
Length of ulna,	right	–	–	259	263	–	–	–	–	–
	left	–	264	–	–	–	264	–	246	–
Diameter of head of femur	right	45.5	42	–	(45)	(45)	45	44.5	40	–
	left	–	41	–	(45)	–	45	–	40	47
Length of femur (bicondylar),	right	–	420	–	408	(ca. 420)	–	(ca. 420)	396	420
	left	–	418	–	412	–	452	–	392	–
Maximum length of tibia,	right	342	365	–	(363)	(ca. 340)	377	–	350	362
	left	–	365	–	360	–	384	–	350	–
Claviculo-humeral index		–	(45.7?)	50.6	51.7	(51.7?)	47.8	(49.3?)	51.2	51.9
Reconstructed stature (by male "Mongoloid" formulae of Trotter and Gleser, 1958) in cm.										
femur + tibia		–	166.14	–	164.3	(ca. 165)	172	(ca. 165)	161.14	166.1
femur only		–		–						
other		(tibia 163.2)		(h + u) 166.9						
Approx. inches		64	65 1/3	(65 3/4?)	65	(65?)	67 3/4	(65?)	63 1/2	65 1/2

Table 36.
Continued.

		#109	#119	#120	#121	#122	#129	#135	#143	#145
Length of clavicle,	right	155	–	152	164	–	–	(ca. 155)	140	–
	left	–	151	154	–	153	–		(140+)	–
Diameter of head of humerus,	right	–	–	47	–	–	–	47	44	–
	left	44	43	–	49	44	–	–	43	(42)
Length of humerus (bicondylar),	right	–	–	323	–	–	–	303	300	–
	left	314	303	–	325	314	–	–	294	300
Length of radius,	right	–	246	258	–	–	–	–	238	234
	left	248	(244)	256	250	255	–	–	–	–
Length of ulna,	right	268	–	274	–	–	–	–	251	(246)
	left	268	–	271	268	268	260	–	250	–
Diameter of head of femur	right	47	(40+)	46	48	–	–	–	(43)	43
	left	46	44	46	–	–	–	43	–	–
Length of femur (bicondylar),	right	430	(between	441	443	–	–	–	(ca. 410?)	(ca. 420)
	left	(433)	420–430)	442	–	–	–	451	–	
Maximum length of tibia	right	384	(ca. 360)	380	378	–	380	–	350	350
	left	–	(1. fib. 343)	380	–	–	–	–	348	–
Claviculo-humeral index		49.4	49.8	47.6	50.5	48.7	–	(51.7?)	46.7	–
Reconstructed stature (by male "Mongoloid" formulae of Trotter and Gleser, 1958) in cm.										
femur + tibia		169.7	(165?)	170.4	170.4	–	–	–	–	(164.3)
						–	–	169.6	–	
femur only										
other						(h + r 169.8)	(tibia 172.3)		(tibia 165.0)	
Approx. inches		66 3/4	(65?)	67	67	66 3/4	(67? cf. #120 and 121)	66 3/4+	(65?)	67 1/3

Table 36.
Continued.

		#149	#161	#207	#212	#217	#230	#256	#260	#262
Length of clavicle,	right	165	154	158	144	154	—	150	159	152
	left	165	148	160	144	159	159	—	162	147
Diameter of head of humerus,	right	46	44	46	42	45	50	43	45	—
	left	46	—	45	42	45	48	45	45	39
Length of humerus (bicondylar),	right	316	290	298	294	—	332	310	318	—
	left	316	—	303	292	317	—	—	320	300
Length of radius,	right	—	—	242	233	—	—	242	248	244
	left	247	—	—	—	245	—	238	244	244
Length of ulna,	right	—	—	262	249	—	(268)	—	271	258
	left	265	—	—	—	261	—	258	266	259
Diameter of head of femur,	right	—	46	—	—	45	(46)	45	42.5	41
	left	45	44	44	42	45	46	—	43	40.5
Length of femur (bicondylar),	right	—	395	414	—	—	(440)	438	431	420
	left	450	398	421	414	424	—	—	434	420
Maximum length of tibia,	right	376	—	374	—	362	379	366	371	366
	left	—	—	372	343	—	—	—	374	368
Claviculo-humeral index		52.2	53.1	53.0	49.15	50.2	47.9	48.4	50.3	49.0
Reconstructed stature (by male "Mongoloid" formulae of Trotter and Gleser, 1958) in cm.										
femur + tibia		171.14	— 157.8	166.75	160.7	166.25	(170.4)	168.5	168.8	166.26
femur only										
other										
Approx. inches		67 1/3	62+	65 2/3	63 1/4	65 1/2	(67?)	66 1/3	66 1/2	65 1/3

Table 36.
Continued.

		#264	#265	#270	#275	#281	#285	#288	#292	#329
Length of clavicle,	right	—	(160?)	143	—	161	162	162	—	(ca. 160)
	left	144	165	—	167	163	—	154	(145+)	—
Diameter of head of humerus,	right	—	46	41.5	47	43	45	—	—	39
	left	(45)	46	41.5	—	43	—	44	43	38
Length of humerus (bicondylar),	right	—	314	302	311	312	308	310	—	302
	left	294	316	(302)	—	314	—	—	300	292
Length of radius,	right	—	252	240	—	240	—	254	—	—
	left	—	246	(238)	250	240	—	252	250	220
Length of ulna,	right	—	270	259	268	255	—	274	—	—
	left	—	(264)	—	—	255	—	(270)	—	—
Diameter of head of femur	right	—	47	43	45.5	43	—	45	44	(40)
	left	—	47	43	45.5	43	—	45	—	40
Length of femur (bicondylar),	right	—	440	436	450	412	—	445	418	(402)
	left	—	444	—	—	414	—	(445)	—	396
Maximum length of tibia	right	—	376	—	372	358	—	384	358	—
	left	—	376	368	372	360	—	386	—	—
Claviculo-humeral index		48.98	52.2	47.35	53.7	51.75	52.6	52.3	(ca. 50)	(over 50)
Reconstructed stature (by male "Mongoloid" formulae of Trotter and Gleser, 1958) in cm.										
femur + tibia		— —	169.2	168.5	170.65	164.3	— —	171.6	165	— 158.6
femur only										
other		(humerus 162)					(humerus 165.7)			
Approx. inches		(63 1/4?— cf. #212)	66 1/2	66 1/3	67 1/4	64 3/5	(65 1/4)	67 1/2	65	(62 1/2+)

Table 36.
Continued.

		#344	#355	#375	#381	#383	#446	#458	#460	#491
Length of clavicle,	right	164	–	152	–	160	–	149	–	"142"
	left	164	146	–	–	–	(150)	151	154	155 (broken and healed off line)
Diameter of head of humerus,	right	– 50	41	45	–	46	48	(47)	–	44
	left	49	–	(43)	–	46	–	47	–	42
Length of humerus (bicondylar),	right	319	320	–	(314)	324	(314)	318	–	298
	left	325	–	–	–	–	(312)	213	–	298
Length of radius,	right	(249)	236	–	252	260	247	–	–	233
	left	248	236	253	(254)	–	245	(250)	–	230
Length of ulna,	right	–	256	–	272	(276)	–	–	–	253
	left	268	–	270	–	–	264	265	–	249
Diameter of head of femur,	right	48	(42?)	45	45	44	47	–	43	45
	left	48	–	(46)	46	44	47	47	–	45
Length of femur	right	434	421	(ca. 430–440)	436	449	435	–	414	408
(bicondylar),	left	434	–	(ca. 430–440)	(438)	451	–	(455)	–	414
Maximum length of tibia,	right	372	363	–	378	(370)	–	–	357	346
	left	362	–	(ca. 360)	376	370	–	(382)	–	348
Claviculo-humeral index		50.9	45.6	–	–	49.4	–	47.6	–	52.01
Reconstructed stature (by male "Mongoloid" formulae of Trotter and Gleser, 1958) in cm.										
femur + tibia		168	166	(168?)	169.7	170.65	–	(172.5?)	165.4	162.85
femur only							166.1			
other										
Approx. inches		66 1/5	65 1/3	(66)	66 4/5	67	Prob. nearer 66	(68)	65	64

Table 36.
Continued.

		#497	#508	Means	Number	Ranges		Means	Number	Range
Length of clavicle,	right	(159)	151	154.4(154.0)	26 (32)	140–165	Revised means and ranges—excluding #262 and #329, and #329, which are females according to Dr. Christy Turner II, and adding #175, #193, and #235, determined by Turner to be male skeletons.	153.3(153.3)	28 (35)	130–165
	left	162	144	154.9(153.9)	26 (29)	144–167		154.05(154.05)	27 (31)	135–167
Diameter of head of humerus,	right	46	–	45.0(45.06)	32 (33)	39–50		45.0 (45.1)	33 (34)	41–50
	left	–	44	44.3(44.2)	28 (31)	38–49		44.7 (44.6)	27 (30)	42–49
Length of humerus (bicondylar),	right	(315)	–	308.4(308.1)	27 (32)	290–332		302.6 (303.15)	29 (34)	282–332
	left	–	303	306.4(306.4)	26 (38)	292–[325]*		305.7 (305.9)	26 (38)	283–[325]
Length of radius,	right	248	243	243.5(243.7)	26 (27)	[232]†–260		242.25 (242.5)	28 (29)	227–260
	left	–	240	244.6(244.9)	24 (28)	220–[252]†		243.7 (244.45)	25 (29)	227–[252]
Length of ulna,	right	–	256	262.1(262.3)	18 (21)	(246) 249–274		261.4 (261.7)	19 (22)	(246) 249–274
	left	264	–	262.05(262.5)	21 (23)	(244) 246–270		260.9 (261.4)	23 (25)	(244) 246–270
Diameter of head of femur	right	45	45	44.66(44.33)	29 (36)	40–48		44.7(44.5)	30 (36)	40–48
	left	–	45	44.38(44.45)	29 (31)	40–47		44.6(44.6)	28 (30)	40–47
Length of femur (bicondylar),	right	ca. 425)	(420)	426.4(424.75)	24 (32)	395–450		423.6(423.3)	26 (33)	386–450
	left	–	427	425.4(428.3)	20 (24)	392–452 (455)		423.2(426.3)	21 (25)	384–452 (455)
Maximum length of tibia	right	–	(354)	367.0(365.54)	28 (33)	342–384		365.3(364.15)	30 (35)	340–384
	left	–	–	366.4(366.86)	19 (21)	343–386		364.9(365.5)	19 (21)	340–386
Claviculo-humeral index		(50.8)	47.5	50.03(50.0)	33 (40)	46.7–53.7		50.1 (50.07)	35 (42)	46.7–53.8
Reconstructed stature (by male "Mongoloid" formulae of Troller and Gleser, 1958) in cm.										
femur + tibia		–	(164.8?)	166.85(166.79	31 (40)	160.7–172.0 (172.5?)		166.4 (166.6)	33 (41)	158.8–172.0 (172.5?)
femur only		(164?)								
other				(166.4)	(7)	(157.8–172.3)			(7)	(157.8–172.3)
Approx. inches		(64 1/2)	(65)	65 3/4 (65 3/4) (62 1/4?–68?)	31 (47)	63 1/4–67 3/4)		65 1/2 (65 3/5)	33 (48)	63 1/4–67 3/4 (62–68)

*No left with longest right humerus (#230).
†No right with shortest left radius (#329).
‡No left with longest right radius (#383).

Table 37.
Long bones, adult females. Note: all measurements in mm. unless otherwise noted.

		#4	#34	#50	#56	#61	#62	#65	#71	#76	#79
Length of clavicle,	right	(145)	140	147	—	135	139	134	—	128	—
	left	—	—	144	—	137	135	132	—	132	135
Diameter of head of humerus,	right	—	40	39.5	—	(41.5?)	40.5	—	—	38	39
	left	—	40	39	—	—	40.5	37.5	39.5	38	—
Length of humerus (bicondylar),	right	(290?)	—	290	—	—	286	—	—	280	284
	left	—	294	284	—	—	282	268	302	280	—
Length of radius,	right	233	246	230	—	216	215	200	228	208	222
	left	—	240	226	230	—	215	200	—	206	—
Length of ulna,	right	255	260	246	—	—	233	218	247	227	242
	left	—	254	237	248	—	233	218	—	225	—
Diameter of head of femur,	right	41	(40.5)	39	41	40	40.5	38	—	39	—
	left	40	—	38.5	—	—	40.5	38	39	38	—
Length of femur (bicondylar),	right	(betw. 360 and 400)	417	398	400	398	388	376	—	—	—
	left		—	402	—	—	(388)	382	416	388	—
Maximum length of tibia	right	—	360	348	—	(340?)	338	306	—	—	—
	left	(fibula 360)	365	—	—	—	—	307	—	329	—
Claviculo-humeral index		—	47.6	50.7	—	—	48.24	45.5	—	45.0	—
Reconstructed stature in cm.											
by Pearson (1899) formulae (f+t)		—	156.98	153.4	—	152.5(?)	150.8	146.4	—	149.9	—
(femur only)		—			(152.5)	(150.3)			(152.8)		—
by Trotter and Gleser (1952) White formulae		—	161.6	157.2	—	155(?)	154.1	148.5	—	152.9	—
(—femur only)		—			(152.9)	152.4)			(156.85)		(hum. 153.4)
the latter, in inches		(prob. betw. 60 and 63)	63½,	62	60¼	(60-61)	60 3/5	58	(61 3/4)	60¼	(58-60½*)

		#87	#126	#140	#142	#148	#152	#158	#162	#163	#165
Length of clavicle,	right	—	134	126	132	—	145	134	—	131	134
	left	128	135	128	136	—	—	134	—	130	—
Diameter of head of humerus,	right	38.5	38	(38?)	39	37	36	—	—	40	38
	left	—	—	—	39	—	—	39	36	—	—
Length of humerus (bicondylar),	right	272	—	267	288	—	300	—	—	281	274
	left	—	280	—	288	283	—	289	258	279	—
Length of radius,	right	202	(210)	203	—	—	—	—	—	213	212
	left	—	—	—	218	213	233	224	—	213	—
Length of ulna,	right	222	—	—	237	—	—	—	226	234	227
	left	—	—	217	235	229	252	242	—	233	(218)
Diameter of head of femur,	right	37	38	—	39	37	38	—	—	38	38
	left	—	—	41	39	—	—	—	35	—	—
Length of femur (bicondylar),	right	372	(388)	—	394	375	(betw. 400 and 420)	—	—	372	382
	left	—	—	368	394	—		—	(360)	373	—
Maximum length of tibia	right	—	326	—	—	—	(betw. 355 and 360)	—	—	326	(312)
	left	322	—	312	334	—		—	—	324	320
Claviculo-humeral index		—	47.86	47.5	46.5	—	46.3	46.36	—	46.26	48.9
Reconstructed stature in cm.											
by Pearson (1899) formulae (f+t)		147.3	(150?)	145.75	151.3	—	(ca. 156?)	—	—	148	148
(—femur only)						145.75		(143)			
by Trotter and Gleser (1952) White formulae		149.7	(152.5?)	147.7	154.4	—	(ca. 159?)	—	—	150.5	150.5
(—femur only)			(tibia only, 155.1)			146.25		(hum. 154)	(143)		
the latter, in inches		59	(ca. 60?)	58	60 3/4	57 3/4	(ca. 60½?)	(ca. 60?)	56½ + 59½		59½

*146 to 154 cm. indicated by comparison with others.

Table 37.
Continued.

		#169	#175	#176	#193	#196	#198	#202	#208	#213	#214
Length of clavicle,	right	133	155	–	130	–	(131)	(134)	(128)	132	–
	left	–	(154)	–	135	–	–	140	–	135	124
Diameter of head of humerus,	right	35	–	40	41	(38)	38	38	39	38	36
	left	–	–	–	–	–	–	38	–	39	–
Length of humerus (bicondylar),	right	282	282	–	283	(275?)	274	284	287	–	276
	left	280	–	285	283	–	–	282.5	–	288	–
Length of radius,	right	224	234	227	235	(220)	212	229	216	222	218
	left	229	234	227	235	–	–	225	–	224	–
Length of ulna,	right	245	254	243	253	240	232	243	(ca. 240)	242	–
	left	236	255	–	253	–	–	240	–	244	238
Diameter of head of femur,	right	38	–	40	45!	41	38	38	38	38	36
	left	–	–	–	45!	–	–	39	38	39	–
Length of femur (bicondylar),	right	410	386	392	414	390	372	400	(betw. 390 and 410)	–	391
	left	417	384	–	414	–	–	399		(ca. 415)	–
Maximum length of tibia	right	342	340	–	358	(342?)	–	344	338	(350)	327
	left	346	340	–	–	–	316	342	340	–	–
Claviculo-humeral index		46.3	53.8	–	46.8	–	47.8	49.5	44.6	46.35	44.9
Reconstructed stature in cm.											
by Pearson (1899) formulae (f+t)		154	149.5	–	156.1	151.35(?)	146.6	152.7	152.5(?)	155(?)	150
(–femur only)				149.1		(148.7)					
by Trotter and Gleser (1952) White formulae		157.5	154.1	–	160.5	154.7(?)	148.8	156.6	155(?)	(ca. 159?)	153
(–femur only)				150.9		(150.4)					
the latter, in inches		62	61 2/3	59½+	63 1/5	ca. 60	61 3/4	61 3/4	(61?)	(62??)	60¼

		#235	#237	#240	#243	#244	#248	#254	#267	#272	#273
Length of clavicle,	right	146	–	–	149	–	139	–	130	–	133
	left	150	–	–	148	–	138	(ca. 120)	–	–	111
Diameter of head of humerus,	right	45!	38	–	42	(38?)	37	34	–	(40)	33
	left	44	–	–	40	36	37	–	(38)	–	33
Length of humerus (bicondylar),	right	285	(286?)	–	296	(278?)	276	(ca. 270)	–	301	244
	left	291	–	–	292	275	274	–	(272)	–	248
Length of radius,	right	227	–	–	(226)	218	212	(206?)	–	(226)	(synostosed)
	left	227	–	245	–	–	208	–	–		
Length of ulna,	right	–	–	–	(244)	233	232	225	–	248	206
	left	249	–	261	238	–	228	–	–	248	204
Diameter of head of femur,	right	43	38	–	41	38	37	36	38	–	–
	left	–	–	–	42	–	37	–	–	40	34
Length of femur (bicondylar),	right	400	402	(425?)	408	(400)	382	385	–	–	–
	left	397	–	–	416	–	382	–	382	408	338
Maximum length of tibia	right	350	(327)	367	358	(320)	322	316	–	334	–
	left	–	–	–	–	–	320	316	320	334	284
Claviculo-humeral index		51.4	–	–	50.5	–	50.04	–	(47.8?)	–	45.5
Reconstructed stature in cm.											
by Pearson (1899) formulae (f+t)		153.6	151.35(?)	(ca. 158)	155.7	(ca. 150?)	148	148	148	152.7	139.6
(–femur only)			(151)								
by Trotter and Gleser (1952) White formulae (–femur only)		157.45	(153)	(ca. 163)	160	(ca. 152?)	150.5	150.5	150.5	156.4	139.7
the latter, in inches		62	ca. 60(?)	ca. 64	ca. 63	ca. 60	59¼	59¼	59¼	61 3/5	55

Table 37.
Continued.

		#282	#289	#291	#295	#302	#320	#325	#331	#337	#339
Length of clavicle,	right	118	(ca. 125)	143	132	131	138	123	130	–	136
	left	116	(ca. 125)	–	–	133	141	–	130	–	–
Diameter of head of humerus,	right	37.5	36	39	40	38	41	38	38	34	37
	left	38	37	40	39	37	40	37	37	–	36
Length of humerus (bicondylar),	right	260	–	282	285	282	298	266	293	290	290
	left	–	281	280	282	280	297	260	292	–	284
Length of radius,	right	196	–	219	(220)	218	227	209	229	220	218
	left	196	222	221	218	222	225	206	226	(218)	(215)
Length of ulna,	right	(ca. 220)	–	–	235	239	243	226	252	239	240
	left		–	234	237	237	239	–	246	236	(236)
Diameter of head of femur,	right	–	38	42	38.5	39	40.5	–	39	37.5	39
	left	–	37	42	38	39	40	37	(39)	37	39.5
Length of femur (bicondylar),	right	(ca. 340)	(395)	400	387	(391)	418	–	394	–	(slightly over 410)
	left	–	(395)	404	391	393	416	371	–	386	
Maximum length of tibia	right	299	(333)	350	334	329	351	320	–	332	–
	left	299	335	348	334	330	353	322	–	336	348
Claviculo-humeral index		45.0	(ca. 44.5?)	50.7	46.3	47.5	46.4	46.8	44.3	–	46.9
Reconstructed stature in cm.											
by Pearson (1899) formulae (f+t) (–femur only)		(141.2)	151.35(?)	153.6	150.3	150.2	155.8	147.75	149	150.2	(154.7)
by Trotter and Gleser (1952) White formulae (–femur only)		(142.2)	154.7(?)	157.45	153.4	153.3	160	149.1	151.4	152.3	(158.8)
the latter, in inches		56	60 3/4	62	60½	60½	63	58½	60½(?)	60	(62½?)

		#389	#392	#394	#400	#401	#404	#407	#409	#410	#417
					(19-yr.-old)					(sex uncertain)	
Length of clavicle,	right	134	(ca. 130)	124	–	135	134	(ca. 135)	(ca. 135)	(140)	137
	left	139		124	–	133	138			144	142
Diameter of head of humerus,	right	43	40	36	–	37	39	–	42	42	40
	left	42	40	36	–	36	39	–	–	42	39
Length of humerus (bicondylar),	right	300	(296)	290	–	279	281	(ca. 295)	293	–	–
	left	294	–	289	–	277	280	(ca. 295)	–	296	294
Length of radius,	right	–	228	227	–	222	222	–	228	224	225
	left	234	–	222	–	221	217	–	–	224	221
Length of ulna,	right	254	–	250	–	241	256	–	247	245	–
	left	–	–	245	(245)	237	250	–	–	244	238
Diameter of head of femur,	right	44	41	39	39	38	41	42	45	–	41
	left	43	40	38	38	37	41	41	44	42	41
Length of femur (bicondylar),	right	414	(near 390)	417	(404)	396	384	420	414	–	408
	left	423	(near 390)	417	(408?)	398	390	–	410	405	412
Maximum length of tibia	right	364		352	(344)	340	330	–	–	–	340
	left	–	–	–	344	340	330	357	–	–	338
Claviculo-humeral index		45.9	–	42.8	–	48.2	48.6	–	(46.1)	48.6	48.3
Reconstructed stature in cm.											
by Pearson (1899) formulae (f+t) (–femur only)		157.2	– (148.7?)	155.75	(153.6?)	152.14	150.2	149.9	– 153	– 151.6	153.6
by Trotter and Gleser (1952) White formulae (–femur only)		161.9	– (150.4?)	160.1	(157.45?)	155.64	153.3	152.9	– 155.85	– 154.1	157.45
the latter, in inches		63 3/4	(59?)	63	(62?)	61	60 1/3	60	61¾	60 3/4	62

Table 37.
Concluded.

		#418	#419	#444	#445	#454	#462	#466	#468	#477	#509
Length of clavicle,	right	127	141	–	135	–	133	144	–	132	–
	left	132	142	137	134	127	135	–	(125?)	134	–
Diameter of head of humerus,	right	40	37	38	37	36	38	(37?)	36	37	38
	left	39	37	38	38	36	38	38	35	37	–
Length of humerus (bicondylar),	right	275	295	272	290	(281)	275	296	252	280	281
	left	272	295	270	286	281	269	298	250	280	–
Length of radius,	right	224	228	–	(230)	–	207	243	202	209	(224)
	left	218	224	–	(230)	214	205	242	198	211	–
Length of ulna,	right	242	246	–	–	–	226	264	219	227	–
	left	236	–	232	242	232	225	260	216	228	–
Diameter of head of femur,	right	42	37	39.5	40.5	–	38	40	35	39	(40)
	left	42	36	39	40	–	38	39.5	35	39	–
Length of femur (bicondylar),	right	394	397	398	407	–	374	420	360	388	383
	left	392	398	401	409	–	378	425	364	388	–
Maximum length of tibia	right	331	330	340	346	–	312	366	302	330	(340)
	left	332	328	–	348	–	313	362	–	330	–
Claviculo-humeral index		47.3	47.9	50.7	46.7	43.2	49.3	48.5	–	47.5	–
Reconstructed stature in cm.											
by Pearson (1899) formulae (f+t) (–femur only)		150.8	151	152.5	154.2	–	146.6	157.5	144	150	(150.26) 147.34
by Trotter and Gleser (1952)						(hum. 148.9)					
White formulae (–femur only)		154	154.2	156	158.15	–	148.8	162.2	145.5	153	(153.7) 148.7
the latter, in inches		60 2/3	60 3/4	61½	62¼	60 (hum. 152.4 cm.)	58½	64	57	60¼	(60½)

		Means	Number	Range		Means	Number	Range
Length of clavicle,	right	134.52 (134.36)	50 (49)	113–155	Without #175, 193, and 235, but including #262 and 329. Among the 1967 crop, both #409 and 410 (at least) may be males. Upper ends of ranges without #409 and 410 are shown in brackets (only the diameters of the femoral head are changed thereby: and #389, now providing the highest figures, is definitely female). Without #262 the maximum stature would be 157.5 cm. (Pearson) or 162.2 cm. (Trotter and Gleser), still translating to inches as 64.	134.26 (134.14)	38 (47)	113–152
	left	134.27 (133.95)	37 (41)	111–150 (154)		134.16 (133.33)	36 (39)	111–148
Diameter of head of humerus,	right	38.24 (38.4)	53 (59)	33–45		38.17 (38.25)	52 (58)	33–43
	left	38.21 (38.2)	41 (42)	33–44		38.09 (38.08)	42 (43)	33–42
Length of humerus (bicondylar),	right	282.16 (282.4)	45 (53)	244–301		282.5 (282.7)	43 (51)	244–302
	left	281.61 (281.7)	45 (47)	248–302		282.01 (282.08)	45 (47)	248–302
Length of radius,	right	220.42 (220.4)	45 (53)	196–246		220.16 (220.18)	43 (51)	196–246
	left	221.33 (221.3)	40 (43)	196–245		221.05 (221.05)	39 (42)	196–245
Length of ulna,	right	239.4 (239.1)	44 (47)	206–264		239.2 (238.8)	43 (46)	206–264
	left	237.9 (237.6)	43 (46)	204–261		237.3 (237.1)	41 (44)	204–261
Diameter of head of femur,	right	39.29 (39.3)	55 (57)	35–45		39.15 (39.18)	54 (57)	35–45 [44]
	left	39.24 (39.2)	42 (43)	34–45		39.13 (39.11)	43 (44)	34–44 [43]
Length of femur (bicondylar),	right	394.93 (394.4)	44 (52)	(340)–420 (425?)		395.2 (394.7)	42 (51)	(340–420 (425?)
	left	395.55 (395.0)	38 (44)	338–425		395.9 (395.4)	37 (43)	338–425
Maximum length of tibia	right	336.65 (336.2)	37 (46)	299–367		336.4 (335.99)	35 (44)	299–367
	left	331.53 (– –)	38 (–)	284–365		332.26 –	38 –	284–368
Claviculo-humeral index		47.47 –	46	42.8–53.8		44.27	44	42.8–50.7
Reconstructed stature in cm.								
by Pearson (1899) formulae (f+t) (–femur only)		150.44 (150.82)	50 (67)	139.6–157.5 (158?)		150.43 (150.82)	48 (66)	139.6–157.8 (#262)
the latter, in inches		60 2/5 (60½)	50 (67)	55–63 4/5 (64)		60 2/5 (60½)	48 (66)	55–64

Table 38.
Comparative data, long bones, males. Note: all measurements in mm.

		Pecos		Paako		Galisteo Sites[†]	
		Means	Ranges	Means	Ranges	Means	Ranges
Length of clavicle	right	149.33	129-172	–	–	–	–
	left	150.52	131-170	–	–	–	–
Diameter of head of humerus,	right	44.28	36-52	–	–	42.5	37-46 (of 15)
	left	43.28	37-50	–	–	–	–
Length of humerus (maximum).	right	310.23	267-358	297.8	280-325 (of 13)	303	289-320 (of 12)
	left	308.25	263-356	299.5	276-324 (of 10)	–	(bicondylar)
Length of radius,	right	239.56	200-270	234.2	209-252 (of 6)	235.8	222-255 (of 10)
	left	238.35	214-270	226.0	210-251 (of 9)	–	–
Length of ulna,	right	259.10	231-284	–	–	–	–
	left	254.78	223-283	–	–	–	–
Diameter of head of femur,	right	42.99	37-49	–	–	43.25	38-47 (of 14)
	left	42.95	36-49	–	–	–	–
Length of femur (bicondylar),	right	423.90	382-492	(presumably Rogers used the maximum)		423.6	403-444 (of 11)
	left	423.24	362-473			–	–
Length of femur (maximum),	right	427.22	384-495	406.2	376-445 (of 11)	–	–
	left	426.71	362-476	412.6	380-447 (of 11)	–	–
Length of tibia[*],	right	357.69	312-415	344.6	320-380 (of 10)	355.4	331-385 (of 10)
	left	357.78	311-413	340.5	317-376 (of 12)	–	–
Claviculo-humeral index		47.53 (from the means)		–	–	–	–

Table 39.
Comparative data, long bones, females. Note: all measurements in mm.

		Pecos		Paako		Galisteo Sites[†]	
		Means	Ranges	Means	Ranges	Means	Ranges
Length of clavicle,	right	131.63	119-150	–	–	–	–
	left	134.89	122-151	–	–	–	–
Diameter of head of humerus,	right	38.73	34.5-44	–	–	39	36.5-42 (of 12)
	left	38.35	35-42	–	–	–	–
Length of humerus (maximum),	right	288.91	259-325	285.5	282-292 (of 4)	293	271-307 (of 12)
	left	285.06	254-324	–	283 and 294	–	(bicondylar)
Length of radius,	right	219.40	193-241	220.5	210-232 (of 4)	217.7	207-238 (of 6)
	left	216.59	190-240	"223.3"	213, 222, 235	–	–
Length of ulna,	right	237.05	212-259	–	–	–	–
	left	235.18	209-264	–	–	–	–
Diameter of head of femur,	right	38.59	35-42	–	–	39.6	38-41 (of 10)
	left	38.35	34-43	–	–	–	–
Length of femur, (bicondylar),	right	391.98	352-442	(presumably Rogers used the maximum)		382.0	340-408 (of 10)
	left	393.03	354-445			–	–
Length of femur, (maximum),	right	394.26	356-445	"397.5"	385 and 410	–	–
	left	396.05	357-446	"390.7"	380, 389, 403	–	–
Length of tibia[*],	right	327.22	288-369	one, 320		324.1	275-348 (of 9)
	left	323.83	285-362	one, 347		–	–
Claviculo-humeral index		46.43 (from the means)		–	–	–	–

Table 38.
continued

		Alkali Ridge		Lowry-Ackmen		Whitewater	
		Means	Ranges	Means	Ranges	Means	Ranges
Length of clavicle,	right	146.6	142-151 (of 5)	–	–	150.3	150, (148) 153
	left	145.6	139-151 (of 5)	–	–	–	(one, 149)
Diameter of head of humerus,	right	42.4	39-47 (of 7)	–	(none)	–	–
	left	42.0	39-47 (of 7)	–	(one, 41.3)	–	–
Length of humerus (maximum).	right	302.7	282-335 (of 7)	"330.5"	(327, and a 334.5)	300.2	282-317 (of 5)
	left	303.3	281-341 (of)	"316.75"	(326.5, and a 307)	296.5	279-315 (of 4)
Length of radius,	right	240.25	226-250 (of 4)	249.75	228-267 (of 4)	237	222-253 (of 4)
	left	244.83	238-267 (of 6)	"248.5"	239 and 258	"236.5"	250 and 223
Length of ulna,	right	268.0	255-288 (of 6)	"257.5"	246 and 269	257	266, 262, 243
	left	261.8	250-290 (of 5)	–	(none)	"239.5"	238 and 241
Diameter of head of femur,	right	42.6	40-47 (of 7)	"39.75"	42.3 and a 37.2	–	–
	left	43.0	41-47 (of 6)	41.96	42.6, 43.3, 40.0	–	–
Length of femur (bicondylar),	right	422.7	385-472 (of 6)	–	(none)	420	425, 419, 416
	left	427.4	390-484 (of 7)	442.6	456, 436, 436	419	395-434 (of 4)
Length of femur (maximum),	right	426.0	391-476 (of 6)	–	(none)	423	429, 422, 418
	left	431.14	393-485 (of 7)		458, 438, 440	422	399-436 (of 4)
Length of tibia*,	right	363.5	324-409 (of 6)	–	(388) and 376	346.3	353, 339, 347
	left	362.0	328-412 (of 8)	"382.5"	390 and 375	"342.5"	340 and 345
Claviculo-humeral index		47.53	44.3-50.0 (5 each side)	–	–	–	48.7 (52.5), 50.3

Sources: Pecos, data, Hooton (1930); Paako data, S. L. Rogers (1954); Galisteo data, Reed (ms. a); Alkali Ridge data, Brues (1946a); Lowry-Ackmen data, von Bonin (1936); and Whitewater data, Stewart (1940).

*Presumably excluding the proximal spines, except in the Galisteo Basin collection.

†On this material I measured only the right (or, if lacking it, the left bone, if present).

Table 39.
continued

		Alkali Ridge		Lowry-Ackmen		Whitewater	
		Means	Ranges	Means	Ranges	Means	Ranges
Length of clavicle,	right	134	(128, 140)	–	–	129	120-136 (of 5)
	left	–	(one, 128)	–	–	131.7	122-137 (of 6)
Diameter of head of humerus,	right	37.0	34-41	37	35-38 (of 4)	–	–
	left	–	(34 and 41)	36.6	35-38	–	–
Length of humerus (maximum),	right	278.2	269-293	287	271-315 (of 5)	282	260-300 (of 8)
	left	–	(269 and 279)	290	276-315 (of 4)	280	259-301 (of 7)
Length of radius,	right	–	(one, 212)	"221"	(219 and 223)	219	202-244 (of 9)
	left	210	(203, 207, 220)	–	(one, 223)	215	220-238 (of 7)
Legth of ulna,	right	"234.5"	(228 and 241)	234.7	(231, 236, 237.5)	233.4	226-247 (of 5)
	left	"231"	(224 and 238)	–	–	233.75	219-249 (of 8)
Diameter of head of femur,	right	a (39)		38.9	37-40 (of 6)	–	–
	left	two, 35 and 36		38.5	37-40 (of 6)	–	–
Length of femur, (bicondylar),	right	one, 362		402.7	379-437 (of 6)	391	369-412 (of 8)
	left	same, 364, and a 386		405.7	388-436 (of 5)	394	371-415 (of 8)
Length of femur, (maximum),	right	same, 363		406.4	383-441 (of 6)	394	374-415 (of 6)
	left	same, 373, and - 390		409.3	392-440 (of 5)	400	377-420 (of 7)
Length of tibia*	right	a (308) and a 332		–	331 and a 340	323	(304)-336 (of 6)
	left	317.7	(306, 317, 330)	–	327 and a 320	325	304-342 (of 7)
Claviculo-humeral index		two, right only, 47.6 and 47.8	–	–	45.8		43.1-47.9 (4 each side)

Sources: Pecos data, Hooton (1930); Paako data, S. L. Rogers (1954); Galisteo data, Reed (Ms. a); Alkali Ridge data, Brues (1946a); Lowry-Ackmen data, von Bonin (1936); and Whitewater data, Stewart (1940).

*Presumably excluding proximal spines, except in the Galisteo Basin collection.

†On this material I measured only the right (or, if lacking it, the left bone, if present).

Table 40.
Stature comparisons, males.*

	Average			Range	
	cm.	in.	No.	cm.	in.
Las Humanas (Mound 7)	166.8	65 2/3	40	160.7-172 (172.5?)	63 1/4-67 3/4
(Additional *not* by f + t or f)	(166.4)	(65 1/2)	7	157.8-172.3	62 1/4-67 4/5
Combined total	166.7	65 2/3	47		
Pecos (recalculated)	165.6	65 1/5		155-181	61-71 1/4
By Pearson (Hooton, 1930, p. 178)	161.7	63 3/4	142	152-176	59 4/5-69 3/10
Paako (recalculated)	161.9	63 3/4	16	153.3-171.8	60 1/3-67 2/3
		(not including two by humerus and radius only)			
By Pearson (S. L. Rogers, 1954, p. 22)	159.05	62 3/5	18	152.0-168.5	59 4/5-66 2/5
Las Madres (LA:25), Galisteo Basin	167.8	66	5	162-171	63 4/5-67 1/3
Pueblo Largo (in the Galisteo Basin)	162.85	64	5	160.2-165.6	63-65 1/5
LA:1333 (in the Galisteo Basin)	164.5	64 3/4	2	161.9, 167.1	63 3/4-65 4/5
Te'ewi (Reed, 1953)	164.3	64 3/5	7	157.2-170.8	62-67 1/4
Mesa Verde (K. A. Bennett, 1975)	165.6	65 1/5	36	157-173	61 4/5-68
Mesa Verde Site 34 (Reed, 1965)	164.2	64 3/5	7	160.4-166.4	63 1/5-65 2/5
Alkali Ridge (Brues, 1946)	165.45	65 1/10	7	157.6-176.5	62-69 2/5
Allantown (Stewart, 1940)	163.8	67 1/2	4	162.6-166.1	64-65 2/5
Range of means (Trotter-Gleser only) and combined total range	161.7-167.8 (63 3/4-66)			152-181	59 4/5-71 1/4

*Trotter and Gleser (1958) Mongoloid formula, using femur plus tibia, unless otherwise noted.

Table 41.
Stature comparisons, females.*

	Mean				Range
	cm.	in.	No.	cm.	in.
Las Humanas-Mound 7 (incl. 5 femora only)	153.4	60 2/5	50	139.7-162.2	
Additional uncertain	153.8		17	(-163?)	
Total	153.6	60 1/2	67	139.7-162.2	55-63 3/5 (64)
Pecos (recalculated)	153.3	60 1/4		142-166.5	56-65 1/2
By Pearson (Hooton, 1930, p. 178)	150.1	59	81	141-160.9	55 1/2-63 1/3
Paako (recalculated)	151.85‡	59 4/5	4	150.2-157.5	59 1/2-60 3/5
By Pearson (S. L. Rogers, 1954, p. 22)	149.9	59	4	148.2-153.9	58 1/2-60 3/5
Pueblo Largo (in the Galisteo Basin)	153.4	60 2/5	5	147.9-156.7	58 1/5-61 3/4
LA:1333 (in the Galisteo Basin)	146.3	57 3/5	3	138.7, 146, 155	54 1/2, 57 1/4 61
Mesa Verde (Bennett, 1975)	155.5	61 1/4	14	145-160	57-63
Alkali Ridge (Brues, 1946)	151.6	59 3/5	3	146.3, 151, (157.5)§	57 3/5-59 1/2 (62)
Allantown (Stewart, 1940)	153.7	60 1/2	7	147.4-158.8	58-62 1/2
Inscription House (Reed, Ms.h)	155.7	61 1/3	9	(147.7)-161.6	(58)-63 1/2
Range of means (Trotter-Gleser only) and combined total range†	151.6-(59-61 1/3-155.7)			138.7-266.5	54 1/2-65 1/2
Individual range, omitting LA:3333 and Las Humanas extremes at the bottom and Las Humanas at the top.				142-161.6	56-63 1/2

*Trotter and Gleser (1952) White female formula, using femur plus tibia unless otherwise noted.
†The mean of three from LA:3333 is omitted here; in a larger series the uniquely small #9 would not have such a drastic effect.
‡One femur plus tibia, two femora only, one humerus; *not* including one radius only.
§From tibia only.

Table 42.
Cranial measurements and indices, adult males, campo santo.
Note: all measurements in mm.

	#4	#5	#8	#9	#11	#12	#13	#15	#16	#18
Length of vault	161	(184)	171	172	(177)	182	159	165	–	165
Maximum breadth	141	–	136	(ca. 140)						
Basion-bregma height	141	–	134	137	–	126	136	147	134	133
Cranial index	87.6	–	79.5	(ca. 81.5)	–	74.7	84.9	(ca. 93.3)	–	87.8
Mean height index	93.4	–	87.2	(ca. 88?)	–	79.2	92.5	(91.9?)	–	93.5
Min. frontal diam.	95	–	92	95	90	93	93	101	–	95
Max. bizygomatic diam.	140	(ca. 150)	(130 to 135)	(ca. 140)	(125 to 130)	142	130	(149)	136)	140
Total face height	115	124	–	–	–	–	112	(128)	–	118
Upper face height	71	81	74	72	67	–	69	78	–	70
Facial index	82.1	–	–	–	–	–	86.15	–	–	84.3
Upper face index	50.7	–	–	(ca. 51)	(ca. 50)	–	53.08	(ca. 52)	–	50.0
Nasal height	51	54	50	49	(47?)	50	49	54	–	49
Nasal breadth	25	24	(25)	26	23	28	25	25	(26)	26
Nasal index	49.02	44.4	(50?)	53.06	(ca. 49)	56.0	51.02	46.3	–	53.06
Orbit height, right	37	38	–	36	34	34	33	38	–	35
Orbit height, left	36	–	35	36	34	32	33	38	–	34
Dacryal breadth, right	42	40	39	38	38	39	40	40	–	30
Dacryal breadth, left	41	–	–	40	38	36	37	40	–	38
Mean orbital index	87.9	(95.0)	(89.7)	92.4	89.5	88.0	85.7	95.0	–	89.6
External palatal length	50	–	(47)	57	–	–	50	55	–	54
External palatal breadth	67	–	–	69	–	–	62	70	–	63
External palatal index	134	–	–	121.05	–	–	124.0	127.3	–	116.7
Mandibular length	104	(112)	–	–	–	–	100	(106)	–	101
Bicondylar width	121	–	–	–	–	–	111	(130 to 135)	–	122
Bigonial width	98	99	–	–	–	–	82	118	–	98
Height of symphysis	35	38	–	–	–	–	35	41	–	34

*Means do not include Deneid specimens, nos. 5, 13, 15, and 19.

Table 42.
Continued.

	#19	#20	Means*	Number	Ranges	A (October 1967)	E (July 1968)	Changes in the Ranges
Length of vault	176	174	169.4 (171.45)	9 (11)	159–182 (184)	185	186	<186
Maximum breadth	138	133	137.7 (139.4)	7 (10)	133–145 (154)	139	132	>132
Basion-bregma height	138	132	135.8	10	126–147	140	132	
Cranial index	77.7	76.4	81.23	7	74.7–87.8 (93.3?)	75.135	70.9	>70.9
Mean height index	87.9	85.9	88.5	7	79.2–93.5	86.4	83.02	
Min. frontal diam.	94	87	93.5	10	87–101	94	96	
Max. bizygomatic diam.	139	131	137.0 (138.3)	6 (8)	130–142 (149)	(135)	139	
Total face height	–	–	117.25 (119.4)	4 (5)	112–124 (128)	125	129	<129
Upper face height	75	70	72.7	10	67–81	74	79	
Facial index	–	–	84.2	3	82.1–86.15	(92.6)	92.8	<92.8
Upper face index	53.6	53.4	52.16	5	50.0–53.6	(54.7)	56.8	<56.8
Nasal height	53	50	50.9	10	49–54	52	54	
Nasal breadth	23	27	25.2 (25.25)	10 (12)	23–28	26	23	
Nasal index	43.4	54.0	50.03	9	43.4–56.0	50.0	42.6	>42.6
Orbit height, right	35	32	35.20	10	32–38	35	37	
Orbit height, left	35	32	34.50	10	32–38	35	34	
Dacryal breadth, right	37	38	39.09	11	37–42	38	38	
Dacryal breadth, left	37	40	38.55	9	36–41	37	37	
Mean orbital index	94.6	82.05	88.5 89.24)	9 (11)	82.05–95.0	93.33	94.7	
External palatal length	49	53	52.6 (51.9)	7 (8)	(47)49–57	55	57	
External palatal breadth	66	64	65.9	7	62–70	69	69	
External palatal index	134.7	120.75	125.6	7	116.7–134.7	125.45	121.05	
	Two unassigned mandibles							
Mandibular length	107 "B"	(110) "C"	103.0 (105.7)	4 (7)	100–107 (112)	104	108	
Bicondylar width	132	–	121.5	4	111–132	115.5	115	
Bigonial width	92	83	95.7	7	82–118	93	104	
Height of symphysis	38.5	35	36.6	7	34–41	37	38	

Table 43.
Cranial measurements and indices, adult females, campo santo.
Note: all measurements in mm.

	#3	#6	#7	#10	#14	Means of #3 to #14	B	C	Means Incl. B and C	Number	D	i
Length of vault	170	154	157	153	169	All deformed except #14	161	156	(both also deformed		172	158
Maximum breadth	142	152	141	152	127		152	142			136	(151)
Basion-bregma height	131	137	–	139	138	136.25	137	128	135.0	(6)	131	–
Cranial index	83.5	98.7	89.8	99.3	75.15	"89.3"	94.1	91.03	"90.23"	(7)	79.1	–
Mean height index	83.9	89.5	–	91.15	93.2	89.45	87.5	85.9	88.5	(6)	85.1	–
Min. frontal diameter	96	93	91	95	88	92.6	92	92	92.4	(7)	95	97
Max. bizygomatic diam.	128	134	133	135	(127?)	132.5	(134?)	136	133.2	(5)	137	136
Total face height	108	110	–	–	–	109.0	–	118	112.0	(3)	(118)	–
Upper face height	63	67	63	71	64	65.6	(72?)	72	66.7	(6)	(73)	70
Facial index	84.4	82.1	–	–	–	83.2	–	86.7	84.4	(3)	(86.1)	–
Upper face index	59.2	50.0	47.4	52.5	–	52.3	–	52.9	52.4	(5)	(53.3)	51.5
Nasal height	46	49	44	51	46	47.2	–	53	48.2	(6)	50	47
Nasal breadth	24	(ca. 25)	24	30	24	25.5	–	27	25.8	(5)	29	24
Nasal index	52.5	–	54.5	58.8	52.2	54.4	–	50.9	53.8	(5)	58.0	51.06
Orbit height, right	34	33	32	33.5	34		35	34			37	37
Orbit height, left	33	33	32	35	33	33.25	–	33	33.4	(13)	38	36
Dacryal breadth, right	39.5	–	38	38	37		38	38	37.7	(11)	38	37
Dacryal breadth, left	38.5	–	36	37	37	37.6	–	36			38	
Mean orbital index	88.2	–	86.5	91.3	90.5	89.13	92.1 (r)	90.5	89.85	(6)	98.7	98.6
External palatal length	51	50	55	46	–	50.5	–	53	51.0	(5)	–	53
External palatal breadth	65	64	(64)	64	–	64.3	–	69	65.5	(4)	–	63
External palatal index	127.45	128.0	(118.2)	139.1	–	128.2	–	130.2	131.16	(4)	–	120.75
Mandibular length	103	93	–	–	–	–	–	106	100.7	(3)	108	–
Bicondylar width	108	108	–	–	–	–	–	122	112.7	(3)	119	–
Bigonial width	76	87	–	–	–	–	94	98	88.6	(4)	97	–
Height of symphysis	30	33	–	–	–	–	34	34	32.75	(4)	38	–

Table 44.
Long bones of five campo santo burials.
Note: all measurements in mm. unless otherwise noted.

		A (Male)	E (Male)
Length of clavicle,	right	146	152
	left	–	149
Diameter of head of humerus,	right	45	46
	left	44	45
Length of humerus (bicondylar).	right	297	296
	left	(295)	295
Maximum length of humerus,	right	298	297
	left	(298)	296
Length of radius,	right	231	236
	left	–	–
Length of ulna,	right	–	(257)
	left	246	(253)
Diameter of head of femur,	right	(43)	43
	left	43	(43)
Bicondylar length of femur,	right	413	420
	left	(416?)	–
Maximum length of femur,	right	417	424
	left	–	–
Maximum (total) length of tibia,	right	–	356
	left	354	351
Length of fibula,	right	348	–
	left	348	344
Claviculo-humeral index,	right	49.16	51.35
	left	–	50.34
Reconstructed stature (by Trotter and Gleser formulae, f + t), in cm.		164.3	165
Stature in inches		(64 3/4)	(65)

Table 45.
Bones of the arm, campo santo. Note: all measurements in mm.

Humerus

Right			Left		
No.	Transverse Diameter of Humeral Head	Bicondylar Length	No.	Diameter of Humeral Head	Bicondylar Length
74	43.5	317	66	44	291
86	41	319	60	–	(312?)
76	45	294	87	43	294
84	–	betw. 315 and 320			
89	–	close to 315			
85	44	betw. 295 and 300	64	42	312
75	–	ca. 300	71	42	(312?)
80	–	ca. 300			
82	–	betw. 295 and 300			
Male					
79	? (42)	307	69	–	around 300
Female					
77	39	292	65	39	289
78	37	292	63	–	ca. 290?
88	37	285	67	36	282
90	35	285	68	37.5	274
81	35	268			

Radius

No.	Right Length	No.	Left Length
139	260	150	(250–255)
138 (incomplete)	260 at least	149	251
136	247	143	(250?)
135 (slender)	245 at least		
134	222	147	(240?)
140	202	146	unmeasurable; large
		142	222
		144	222
		145	222

Table 46.
Bones of the leg, campo santo.
Note: all measurements in mm. unless otherwise noted.

Femur Dimensions

		Right						Left
No.	Sex	Diameter of Head	Bicondylar Length	Reconstructed Stature*	No.	Sex	Diameter of Head	Bicondylar Length
32	*m*	45	442	167.6 (66")	53	*m*	45	446
42	*m*	44	424	163.7 (65 1/2")	49	*m*	45	–
39/43	*m*	44	betw. 420 and 440	ca. 165 (ca. 65")	50	*m*	43	433
					48	*m*	43	–
38	*m*	42.5	betw. 420 and 425	ca. 163 (64 1/4")	54	*m*	42	(430 ?)
					58	*m*	42	428
31		42	420	162.9 (64")	57	?	42	420
					51	?	–	(ca. 420 ?)
33	?		ca. 400	M: 158.6 ? F: 153 ?				
					56	*f*	(42)	393
30	*f*	40	394	ca. 151	46	*f*	37	388
34	*f*	38	392	ca. 151	47	*f*	38	398

Tibia Lengths (Maximal)

No.	Right Length	No.	Left Length
156	388	176	383
152	384	180	382
		179	370
162	336	169	358
165	336		
158	(cf. above)	173	342
		174	342
151	330	171	339
157	329		
164	322	170	332
163	320	168	330
		172	betw. 325 and 330
		166	326
		177	324
		167	betw. 320 and 325

*In cm. (inches). For males, calculated by the Trotter and Gleser (1958) "Mongoloid" formula, 2.15 cm. X f, plus 72.57 cm.; for females, by the Trotter and Gleser (1952) White formula, 2.45 cm. X f, plus 54.1 cm.

Table 47.
Selective Comparison
(Adult males with nasal index below 49.00.)
Note: all measurements in mm.

	Mound 7, Las Humanas (Gran Quivira)					*Campo Santo* of San Ysidro				Pueblo Pardo	Deneid
	#120	#149	#207	#333	#391	#5	#13	#15	#19	#36	Type Series
Length of vault	171	173	(167?)	179	186	(184)	159	165	176	181	179.9
Maximum breadth	147	136	(ca. 145)	143	131	–	135	(154)	138	125	145.0
Basion-bregma height	144	139	–	141	142	–	136	147	138	129	132.2
Cranial index	85.96	78.6	–	79.84	70.4	–	84.9	(93.3?)	77.7	69.6	80.74
Mean height index	90.56	86.9	–	87.6	89.6	–	92.5	(91.9?)	87.9	84.3	81.44
Max. bizygomatic diam.	140	143	–	146	140	(ca. 150?)	130	(149)	139	126	141.9
Total face height	127	133	122	–	127	124	112	(128)	–	115	122.4
Upper face height	77	81	71	81	75	81	69	78	75	70	73.3
Facial index	90.7	93.01	–	–	90.7	–	86.15	–	–	91.3	85.03
Upper face index	51.4	56.64	–	55.5	53.6	–	53.03	(52.35)	53.6	55.5	52.05
Nasal height	54	55	53	58	49	54	49	54	53	51	52.4
Nasal breadth	26	26	22	26	22	24	25	25	23	24.5	25.7
Nasal index	48.14	47.27	41.5	44.8	44.9	44.4	51.02	46.3	43.4	48.0	48.97
Orbit height, right	38	36	35	37	35	38	33	38	35	36	–
Orbit height, left	38	34	35	37	33	–	33	38	35	36	35.7
Dacryal breadth, right	40	40	40	42	40	40	40	40	37	36	–
Dacryal breadth, left	36	40	39	40	39	–	37	40	37	36	(44)*
Mean orbital index	96.2	92.5	90.9	90.24	86.1	95.0	85.7	95.0	94.6	100.0	81.28
Ext. palatal length	53	56	–	59	53	–	50	55	49	51	53.2
Ext. palatal breadth	66	69	–	71	68	–	62	70	66	61	66.2
Ext. palatal index	124.5	123.2	–	120.34	128.3	–	124.0	127.3	134.7	119.6	124.7

*Orbital breadth measured from maxillofrontale instead of dacryon (adds about 2 mm.).

Table 48.
Cranial measurements and indices, Pueblo Pardo.
Note: all measurements in mm.*

	Males #9	#15	#16	#30	#33	#36	Means	Females #12	#32
Length of vault	172	(176)	175	176	[157]†	181	176	170	167
Maximum breadth	(138)	(146?)	133	130	[144]†	125	129.3	132	131
Basion-bregma height	–	(restored)	127	(133?)	130	129	128.7	137	131
Cranial index	(sl. def.)	–	76.0	73.9	(def.)	69.6	73.2	77.6	78.4
Mean height index	–	–	82.5	–	80.4	84.3	82.4	80.6	87.9
Min. frontal diameter	92	90	82	84	94	90	88.7	88	87
Max. bizygomatic diam.	136	143	132	128	138	126	133.8	130	129
Total face height	117	123	118	(118)	122	115	119.0	115	117
Upper face height	(68)	72	75	70	75	70	72.4	67	70
Facial index	86.0	86.0	89.4	–	88.4	91.3	88.1	88.5	90.7
Upper face index	–	50.3	56.8	54.7	54.3	55.5	54.3	51.5	54.3
Nasal height	50	50.5	52	48	51	51	50.4	50	50
Nasal breadth	25	27	27	26	25	24.5	25.75	25	23
Nasal index	50.0	53.5	51.9	54.2	49.02	48.0	51.1	50.0	46.0
Orbit height, right	39	35	35	33	37	36	35.8	35	35
Orbit height, left	39	34	35	33	37	36	35.7	35	35
Dacryal breadth, right	39	40	41	38	38	36	38.7	37	37
Dacryal breadth, left	39	39	41	36	38	36	38.1	37	37
Mean orbital index	100	87.3	85.4	89.1	97.4	100	94.9	94.6	94.6
External palatal length	–	(66?)	–	55	48	51	51.3	51	54
External palatal breadth	–	(64)	–	63	64	61	62.7	62	64
External palatal index	–	–	–	114.5	113.3	119.6	122.5	121.6	118.5
Mandibular length	–	–	104	–	95	102	100.3	104	102
Bicondylar width	–	–	120	–	124	111	118.3	117	108
Bigonial width	108	119	94	94	105	95	102.2	93	84
Height of symphysis	34	38	31	36	32	34	34.2	32	35

*The dimensions in parentheses are uncertain, and are therefore not included in the means.
†Because of deformation, these are not included in the means.

Table 49.
Measurements of long bones, Pueblo Pardo.
Note: all measurements in mm. unless otherwise noted.

	Males #9	#15	#16	#30	#33	#36	Male Means	Females + #12	#32
Right clavicle, length	156 (left)	157*	133	138	144*	(immature)	146.0	142	133*
Right humerus, diam. of head	44	47	38	40	40	44	42.0	39	36
Humerus, max. length	316	318	(306)	296	288	272†	304.8	285	284
Right radius, length	247	252	234	224	232	–	237.8	220	218
Right femur, diam. of head	44 (left)	44	39 (left)	39	41	45	42.0	39	37
Femur, max. length	444 (left)	445	415 (left)	400	395	410	418.2	378	404
Right tibia, max. length	370 (left)	371	353	326	340	352	352.0	342	341
Claviculo-humeral index	49.37	49.37‡	(43.46?)	46.62	–	–	–	49.82	–
Reconstructed stature, in cm. (calculated by Trotter and Gleser, 1958, "Mongoloid" male formulae) from the:						Reconstructed stature, in cm. (calculated by Trotter and Gleser, 1952, "White" female formulae):			
femur + tibia	169.7	169.9	164.1	158.9	160.0	163.3	164.3	153.3	156.75
femur alone	167.0	168.2	161.8	158.6	157.5	160.7		147.5	153.9
humerus	167.9	168.4	–	162.5	160.4	–		153.7	153.4
humerus + radius	168.8	170.0	(154.8)§	161.7	161.7	–		(158.3)§	(158.2)§
Estimated approximate stature, in inches	66 1/2	66 1/2	64 1/2	62 3/5	63	64 1/5	64 3/5	60 1/3	61 3/4

*Without medial (sternal) epiphysis.
†Without proximal epiphysis (head).
‡Not including clavicle #33 or humerus #36.
§Calculated from radius alone.

Table 50.
Comparative data—male crania.
Note: all measurements in mm.*

	Las Humanas –Mound 7	Pecos (first 5 items, undeformed)	Hawikuh (undeformed)	Durango (Colo.) Basketmakers	Navajo Reservoir	Wetherill Mesa	Alkali Ridge, Southeastern Utah	Otámid type series Texas Gulf Coast	Deneid Type Series	Sully Site, S. Dak. (Arikara)	Pawnee (from sites in Neb.)
Length of vault	176.35	175.74	175.8	180.9	172.6	167.6	164.4	189.3	179.9	179.4	175.8
Maximum breadth	138.55	137.84	133.4	135.0	135.3	145.2	147.8	133.5	145.0	140.1	139.6
Basion-bregma height	137.9	137.14	133.5	130.6	134.3	141.3	140.7	140.4	132.2	133.4	128.7
Cranial index	78.2	78.30	75.9	74.7	78.8	Meaningless because of deformation		70.7	80.74	78.3	79.34
Mean height index	87.6	(87.47)	86.3	(82.7)	83.2			(86.9)	81.44	83.6	81.55
Minimum frontal diam.	93.12	94.9	–	93.1	91.9	95.1	92.5	92.2	94.2	93.5	92.86
Maximum bizygomatic diam.	138.9	138.6	134.45	137.8	133.0	136.7	135.2	134.2	141.9	140.56	140.0
Total face height	125.1	119.4	121.9	120.2	114.7	121.0	121.8	128.3	122.4	–	–
Upper face height	75.0	72.85	73.3	73.6	69.4	73.4	75.0	78.0	73.3	72.75	73.23
Facial index	89.9	85.7	90.4	90.8	86.2	88.45	92.6	97.4	85.03	84.6	84.4
Upper face index	54.3	52.1	54.4	56.6	52.1	53.9	55.7	59.0	52.05	52.15	51.8
Nasal height	52.04	50.96	50.97	51.5	48.4	51.5	52.8	56.7	52.4	53.9	52.8
Nasal breadth	26.0	25.8	25.16	27.7	26.4	25.5	24.8	25.2	25.7	26.6	25.7
Nasal index	50.3	50.44	46.5	53.8	54.7	49.6	49.2	44.3	48.97	49.3	49.03
Orbit height, left	34.9	34.9	35.1	36.4	35.3	34.8	33.8	33.6	35.7	–	–
Orbit breadth, left	38.9	39.5	37.75	40.2	39.14	38.05	38.1	39.9	(42?)	–	–
Left orbital index	(89.8)	(88.35)	91.3	91.3	–	–	89.1	85.02	(ca. 85?)	82.3	85.7
Mean orbital index	90.13	87.8	–	–	111.7	84.91	–	–	(published figures from maxillo-frontale)	–	–
External palatal length	54.7	55.04	54.2	55.0	55.9	51.85	53.0	56.6	53.2	–	–
External palatal breadth	66.9	65.5	64.7	68.0	64.9	66.3	66.2	64.7	66.2	–	–
External palatal index	123.16	119.16	119.6	124.5	116.3	119.6	118.4	114.9	124.7	117.6	118.2
Height of symphysis	36.7	35.4	36.5	34.8	34.4	35.0	34.0	38.9	35.1	–	–

*Parenthesized indices are calculated from the means of the measurements involved.
Sources: Pecos data, Hooton (1930); Navajo Reservoir data, K. A. Bennett (1966a); Wetherill Mesa, K. A. Bennett (1975); Alkali Ridge data, Brues (1946a); Sully Site and Pawnee data, Bass (1964).

Table 51.
Comparative data—female crania.
Note: all measurements in mm.*

	Las Humanas —Mound 7	Pecos (first 5 items, undeformed)	Durango (Colo.) Basketmakers	Pindi Pueblo	Swarts Ruin
Length of vault	167.95	163.65	172.0	158.0†	157.4†
Maximum breadth	134.63	138.04	137.4	139.0†	136.0
Basion-bregma height	132.53	133.90	128.3	132.2†	134.8†
Cranial index	79.96	84.32	80.4		
Mean height index	89.03	(88.76)	(82.9)		
Minimum frontal diam.	90.0	92.41	90.0	90.7	92.0
Maximum bizygomatic diam.	129.15	129.87	129.0	123.0	128.0
Total face height	113.0	113.31	105.0	106.7	110 (1)
Upper face height	68.4	69.04	65.3	67.2	66.25
Facial index	85.80	86.95	81.4	82.5	85.3 (1)
Upper face index	52.15	53.00	49.6	51.0	51.6
Nasal height	48.21	48.20	47.7	46.6	47.7
Nasal breadth	25.26	25.33	25.0	25.0	25.0
Nasal index	51.91	52.60	52.7	53.7	53.2
Orbit height, left	34.28	34.49	33.0	34.14	33.3
Orbit breadth, left	37.27	38.14	38.3	37.3	39.4
Left orbital index	(91.9)	(90.4)	86.0	91.8	(84.5)
Mean orbital index	91.67	89.87	—	—	87.99
External palatal length	51.15	53.97	51.0	51.75	52.6
External palatal breadth	62.7	62.74	63.5	62.3	64.7
External palatal index	123.5	116.32	124.9	123.7	121.4
Height of symphysis	34.0	33.65	32.0	30.8	33.0

*Parenthesized indices are calculated from the means of the measurements involved.
†All crania deformed.

Table 52.
Arizona State University Department of Anthropology
Gran Quivira Project

Participant	Title	Status*
C. G. Turner II	Introduction to the Arizona State University Study of Gran Quiviran Physical	1
Nancy T. Morris	The Occurrence of Mandibular Torus	1, 3a, 5
G. Richard Scott	A Stature Reconstruction of the Skeletal Population	1
Sheila Coyne	Mandibular First Premolars	1
R. J. Burch and C. G. Turner II	The Outward Appearance of the Average Male Face	1
C. G. Turner II and Joseph Katich	Tympanic Plate Dehiscences in Crania	1
Mahmound Y. El-Najjar	A Comparative Study of Facial Dimensions	1, 3a
Kenneth R. McWilliams	Non-metric Oral Traits	1
Sheila Coyne	Variations and Pathologies in the Columns	1
C. G. Turner II	Human Skeletal Inventory, Gran Quivira, National Monument	1
Robert G. Chenhall	Numerical Distance Calculations with Skeltons from Gran Quivira and Elsewhere in the Southwestern United States	2
Ann Ramenofsky	Osteoarthritis: Its Cultural Effects at Gran Quivira	2
Peggy Bodine	Gran Quivira Congenital Hip Study	2
Meredith Larson	Fluorine Analysis	2
Nancy T. Morris	Order of Epiphyseal Union at Gran Quivira	2
Patrick Morris	Aspects of the Vertebral Column Variation	2
Cheryl Regan	Dental Pathology at Gran Quivira	2
Kenneth R. McWilliams	The Utility of the Superior Axis Foramen in the Analysis of Cremated Human Skeletons	2
Judith G. Bowman	The Digastric Notch, Occipital Groove, Juxtamastoid Eminence, Tympanic Plate, Superior Sagittal Sinus and Mastoid Process	2
Chad Phinney	Attrition in the Gran Quivira Dentition	2
Barbara Porter	Cranial Deformation	2
Robert T. Dickie	The Nasal Region	2
Edward F. Harris	Growth Disturbances in Bone as Seen by X-ray Technique	2, 3b
Meredith Larson	The Dental Morphology	3b
Don Simonis	Physical Features and Burial Patterns	2
J. Bennett, T. Burch, and C. G. Turner II	A Paleopathological Specimen of Massive Youthful Joint Disease	4
Donald H. Morris	Maxillary Premolar Variation	6
Charles Merbs	The Vertebral column in Native Americans	6
Steven Molnar	American Indian Dental Wear Patterns	6
G. Richard Scott	Canine *tuberculum dentale*	6
G. Richard Scott	The Dentition of Southwestern Indians	6
C. G. Turner II and Nancy T. Morris	A Massacre at Hopi	5, 6
C. G. Turner II	Cusp 6 and 7 Standard Dental Plaques	5, 6

*Status:
1. Paper included in the present collection.
2. Paper prepared for seminar or research.
3. M.A. thesis (a) completed, (b) in progress.
4. In progress.
5. Paper presented at a scientific conference.
6. Gran Quivira series used for some comparative purpose.

Table 53.
Human skeletal inventory from the Gran Quivia district.*

Gran Quivira Chronology (after Hayes, 197-)
Early Phase A.D. 1315-1400
Middle Phase A.D. 1400-1550
Late Phase A.D. 1550-1672 (town abandoned)

Skeletal Age Classification Notation

Turner		Reed	
0	Fetal	1	Neonate, fetal or premature
1	Infant (x-3 years)	2	First year of life
2	Child, young (4-6 years)	3	1-4 years
3	Child (7-12 years)	4	4-18 years
4	Adolescent (13-17 years)	5	Youthful adult (18-21 years)
5	Sub-adult (18-20 years)	6	Early and middle 20's
6	Yound adult (21-35 years)	7	Mature adult (27-38 years)
7	Middle age adult (36-55 years)	8	Adult (35-ca. 42 years)
8	Old adult (56-75 years)	9	Adult (42-50 years or over)
9	Senite (76-x years)	10	Adult of indeterminate age
10	Adult of indeterminate age		
11	Age indeterminable		

Burial No.	Catalog No.	Field Specimen No.	Age Reed	Age Turner	Sex Reed	Sex Turner	Time Period
14	Q3193/37	304	5	6	M	M	E
16	Q3200/37	351	10	7	M	?	E
17	Q3189/37	352	8	7	M	M	E
21	Q3194/37	469	8	7	M	M	M
34	Q3188/37	892	9	7	F	F	M
41	Q3192/37	1267	9	7	M	M	L
50	Q3190/37	1589	6	6	F	F	L
57	Q3922/37	1690	8	7		?	?
62	Q3187/37	1997	7	7	F	F	L
65	Q3186/37	2240	7	6	F	F	L
71	Q3198/37	2051	6	6	F	F	M
76	Q3185/57	2180	8	7	F	F	M to L
79	Q3184/37	2313	10	7	F	?	M
92	Q3201/37	2317	10	10		F	
95	Q3195/37	2344	2	1	?	?	L
96	Q3196/37	2349	3	1	?	?	M to L
104	Q3199/37	2476	4	2	?	?	L
107	Q6311/37	2631	2	1		?	M to L
108	Q6312/37	2633	2	1		?	M to L
109	Q3887/37	2710	9	7	M	M	L
118	Q3893/37	2844	6	7	?	F	M
119	Q4005/37	2987	8	7	M	M	E to M
120	Q3864/37	3154	7	7	M	M	E to M
121	Q3901/37	3111	8	7	M	M	M to L
126	Q3994/37	3170	9	7	F	F	E to M
129	Q3899/37	3221	10	6	M	M	M
131	Q4006/37	3243	3	1	?	?	E
132	Q4007/37	3250	4	2	?	?	M
136	Q3895/37	3278	8	7	?	?	E
137			2	1		?	E
139	Q6313/37	3311	3	1		?	E?
140	Q3900/37	3312	10	10	F	F	E
142	Q3882/37	3383	10	8	F	F	E
149	Q3902/37	3553	7	6	M	M	M
150	Q4004/37	3580	10	6	?	F	M
152	Q3863/37	3791	7	6	F	F	M
153	Q6314/37	3788	3	1		?	M?
158	Q3866/37	2833	7	7	F	F	L
160	Q3865/37	3848	1	1	?	?	E
161	Q3867/37	3849	8	8	M	M	E

*Preparation and checking of this osteological listing was aided by Nancy T. Morris, Anna Platz, Cheryl Regan, Joseph Katich, and Robert Brown, with funds made available for this purpose, as well as for storage, preservation, and skeletal restoration, from the Department of Anthropology and the National Park Service.

Table 53.
Continued.

Burial No.	Catalog No.	Field Specimen No.	Reed	Age Turner	Reed	Sex Turner	Time Period
163	Q3883/37	3942	7	7	F	F	E
165	Q3884/37	3988	6	6	F	F	E
168	Q3898/37	4083	10	7	F	F	L
169	Q3893/37	4163	5	6	F	F	L
170	Q6135/37	4164	1				L
171	Q3891/37	4214	4	4	?	M	L
174			4	2		?	E?
175	Q3881/37	4218	9	8	F	M	E
176	Q3886/37	4187	7	7	F	F	M to L
180			3	1		?	M
188	Q6316/37	4448	1	0		?	L
193	Q3862/37	4454	6	6	F	M	M to L
195	Q6317/37	4467	3	1		?	M?
196	Q3896/37	4469	6	5-7	F	?	L
198	Q3897/37	4480	7	6	F	F	E
199	Q3860/37	4535	2	1	?	?	E
200	Q3861/37	4536	4	2	?	?	E
202	Q3858/37	5753	9	8	F	F	L
207	Q3871/37	4672	8	7	M	M	L
209	Q6318/37	4701	3	1	?	?	M
211	Q3874/37	4713	4	4	?	F	L
212	Q3875/37	4794	9	7	M	M	L
213	Q3879/37	4838	5	5	F	F	M
214	Q3870/37	4837	5	5	F	F	L
217	Q3876/37	4927	8	7	M	M	L
218	Q6319/37		1	0		?	L
226	Q6321/37	4964	3	2	?	?	M
227	Q6322/37		4	2		?	L
230	Q3872/37	5011	10	7	M	M	M to L
235	Q3873/37	5021	6	7	F	M	M
243	Q3878/37	5126	6	6	F	F	M
244	Q3880/37	5152	10	7	F	F	M
246	Q6320/37		3	1		?	L
247	Q3856/37	5176	9	7	?	F	M
248	Q3854/37	5177	6	6	F	?	M
249	Q6307/37		3	1	?	?	L?
251	Q6308/37		3	1	?	?	
252	Q6323/37	5205	3	1		?	
254	Q3885/37	5237	6	6	F	F	M
254	Q3892/37	5237		0	?	?	M
256	Q3877/37	5273	8	7	M	M	L
257	Q3853/37	5274	4	3	?	?	M
260	Q3852/37	5330		6	M	M	M
261	Q3923/37	5349	4	4	?	?	M
262	Q3851/37	5350	7	6	M	F	M
265	Q3850/37	5394	8	8	M	M	E
266			1	1		?	L
268	Q3849/37	5422	4	4	?	?	L
271	Q3848/37	5598	4	4	?	?	M
273	Q3847/37	5669	6	7	F	F	E
274	Q3888/37	5780	4	3	?	?	M
275	Q3855/37	5821	6	7	M	M	L
281	Q3845/37	5908	7	8	M	M	L
282	Q3846/37	5914	7	7	F	F	L
283	Q3841/37	5922	4	3	?	?	L
284	Q3842/37	5928	4	2	?	?	M
285	Q3890/37	5929	7	7	M	M	L
286	Q6309/37		3	1		?	L
287	Q3924/37	5964	4	4	?	?	L
288	Q3889/37	5965	7	7	M	M	L
289	Q3868/37	5970	7	6	?	F	L
290	Q3859/37	6005	4	2	?	?	L
291	Q3840/37	6006	7	6	F	F	L
292	Q3833/37	7103	10	7	M	M	L
295	Q3838/37	6029	6	6	F	F	L
297			3	1		?	L
302	Q3836/37	7026	7	7	F	F	L
306	Q6325/37	7104	1	1		?	L
313	Q3844/37	7342	4	2	?	?	L
314	Q6326/37		2	1		?	M
320	Q3839/37	7416	6	6	F	F	M
325	Q3837/37	7563	7	7	F	F	M
329	Q3835/37	7624	9	8	M	F	M
331	Q3834/37	7657	10	7	F	F	M
332	Q3869/37	7650	10	3		?	?
333	Q3857/37	7637	10	7	M	M	M
335	Q4194/37	7717	3	1		?	L
337	Q4195/37	7964	7	7		F	L
338	Q4196/37	7965	3	1		?	unknown
339	Q4197/37	8025	6	4		F	M
341	Q4432/37	8239	8				unknown
344	Q4198/37	8272	7	7		M	M
355	Q4199/37	8453	7	7		M	L
367	Q4200/37	8586	3	1		?	L
368	Q4201/37	8588	2	1		?	L
374	Q4422/37	8646	10	8		F	L
375	Q4423/37	8668	10	8		M	E to M
379	Q4202/37	8856	3	1		?	M

Table 53.
Continued.

Burial No.	Catalog No.	Field Specimen No.	Age		Sex		Time Period
			Reed	Turner	Reed	Turner	
380	Q4424/37	8877	10	7		F?	unknown
381	Q4425/37	8927	7	7		M	M
382	Q4203/37	8932	4	1		?	M
383	Q4205/37	9010	6	6	M	M	M
385	Q4204/37	8965	3	1		?	L
389	Q4206/37	9011	8	8	F	F	L
390	Q4207/37	8999	4	4		?	E
391	Q442/37	9832	10	7	M	M	L
392	Q4208/37	9090	7	7		M	L
393	Q4209/37	9091	4	1		?	L
394	Q4211/37	9140	6	6	F	F	L
395	Q4210/37	9168	3	1		?	L
399	Q4212/37	9339	4	1		?	M
401	Q4213/37	9356	7	8	F	F	L
402	Q5636/37	9400	4	2		?	E
403	Q4214/37	9401	4	3		?	L
404	Q4215/37	9416	6	6	F	F	M
407	Q4216/37	9444	7	8		F	E
408	Q4217/37	9582	1	1		?	M to L
409	Q4439/37	9728	9	8		F	L
410	Q4218/37	9757	10	8	F	F	L
414	Q4219/37	9794	3	1		?	L
417	Q4426/37	9901	6	6	F	F	L
419	Q4427/37	9947	7	6	F	F	L
428	Q4220/37	10035	6	6		F	unknown
432	Q4221/37	10036	3	1		?	L
434	Q4222/37	10041	2	1		?	L
435	Q4250/37	10045	3	1		?	L
436	Q4223/37	10095	3	1		?	M
437	Q4224/37	10109	7	7	M	M	L
441	Q4433/37	10224	10	10		?	M to L
442	Q4225/37	10235	2	1		?	M to L
444	Q4226/37	10237	7	7		F	M to L
445	Q4440/37	10258	7	7		F	L
446	Q4428/37	10259	10	8		M	L
449	Q4251/37	10366	2	1		?	L
454	Q4429/37	10420	10	6		F	L
455	Q4227/37	10443	3	1		?	L
456	Q4228/37	10530	3	1		?	M to L
457	Q4229/37	10552	4	2		?	unknown
458	Q4252/37	10560	5	4	M	M	M to L
460	Q4230/37	10574	7	7		F	L
462	Q4231/37	10715	7	7	F	F	M to L
463	Q4232/37	10722	3	1		?	L
465	Q4233/37	10725	3	1		?	unknown
466	Q4234/37	10727	7	6	F	F	unknown
466B	Q4234/37	10728					
468	Q4430/37	10732	6	6		F	L
470	Q4235/37	10731	1	1		?	unknown
471	Q4253/37	10733	3	1		?	unknown
474	Q4236/37	10882	3	1		?	L
477	Q4438/37	10899	7	7	F	F	L
480	Q4237/37	10942	3	1		?	L
485	Q4238/37	10944	4	3		?	L
486	Q4239/37	10947	4	4		F	M
487	Q4240/37	11023	4	3-4		?	M
489	Q4241/37	10946	4	2		?	unknown
490	Q4242/37	10982	4	2		?	M
491	Q4441/37	10983	7	8	M	M	M
492	Q4243/37	10985	4	2		?	M to L
493	Q4244/37	11005	4	3		?	M
497	Q4245/37	11057	7	7	M	M	L
498	Q4246/37	11058	3	1		?	L
502	Q4247/37	11106	3	1		?	L
508	Q4248/37	11163	10	7	M	M	L
509	Q4249/37	11165	7	7		?	L
	Q3951/37	4761		6		M	?
	Q3952/37	5604		7		?	?
	Q3953/37			7		M	?
	Q3955/37	4158		7		?	?
	Q4434/37	9481		10		?	E to L
	Q4435/37	7790		10		?	L
	Q4436/37	8064					E to M
	Q4443/37			10		?	Pre-E
	Q5008/37 A	11327		7		M	L-Campo Santo
	Q5009/37 B	11328		7		F	"
	Q5010/37 C	11329		6		F	"
	Q5635/37	5619					

Table 53.
Continued.

Gran Quivira Cremations (Late Phase)

Burial No.	Catalog No.	Field Specimen No.	Age (Turner)	Sex (Turner)
154	Q3919/37	3794	1	?
155	Q3920/37	3822	1	?
156	Q3921/37	3824	1	?
157	Q3903/37	3830	3	?
178	Q3904/37	4265	10	F
185	Q3905/37	4430	10	?
187	Q3906/37	4455	10	?
215	Q3907/37	4840	6	F
220	Q3908/37	5007	10	?
222		4961	?	?
223	Q3909/37	5008	6	M
228	Q3910/37	4974	6	F
239	Q3911/37	7258	7	?
293	Q3912/37	6017	10	?
294	Q3913/37	6016	10	?
298	Q3914/37	6032	7	M
300	Q3915/37	6028	7	F
326	Q3916/37	7515	7	?
327	Q3917/37	7525	10	?
330	Q3918/37	7645	7	M
345	Q444/37	8328	10	?
346	Q4445/37	8330	10	?
347	Q4446/37	8333	10	?
348	Q4447/37	8336	?	?
349	Q4448/37	8371	10	?
405	Q4975/37	9417	1	?
411	Q4976/37	9779	?	?
412	Q4977/37	9783	10	?
413	Q4978/37	9790	10	?
415	Q4979/37	9859	10	?
416	Q4980/37	9876	?	?
420	Q4981/37	9977	7	?
421	Q4983/37	9982	10	F?
423	Q4982/37	9984	6	?
424	Q4984/37	10000	2	?
425	Q4985/37	10004	6	?
426	Q4986/37	10008	1	?
427	Q4987/37	10011		
429	Q4988/37	10014	?	?
430	Q4989/37	10018	?	?
431	Q4990/37	10021	6	M?
433	Q4991/37	10037	6	?
447	Q4992/37	10290	6	?
448	Q4993/37	10292	?	?
453	Q4994/37	10387	2	?
461	Q4995/37	10701	6	F?
469	Q4996/37	10807	10	?
472	Q4997/37	10884	10	?
475	Q4998/37	10932	10	?
476	Q4999/37	10880	7	?
484	Q5000/37	11024	2	?
488	Q5001/37	11036	2	?
495	Q5002/37	11042	10	?
499	Q5003/37	11074	?	?
501	Q5004/37	11078	10	?
503	Q5005/37	11107	6	?
504	Q5006/37	11152	6	?
506	Q5007/37	1158	10	?

Table 54.
Quantitative Summary of Gran Quivira Human Remains.*

Time Period	Sex	Fetal <0	Infant 0-3	Child 4-6	Child 7-12	Adolescent 13-17	Sub-Adult 18-20	Young-Adult 21-35	Middle Age 36-55	Old Adult 56-75	Senile >75	Adult Age ? (adult)	Age ? ?	Number	Totals Percent
Late	M	0	0	0	0	1	0	0	17	2	0	0	0	20	9.7
	F	0	0	0	0	1	1	12	10	6	0	0	0	30	14.6
	?	2	24	4	3	2	0	1	1	0	0	1	1	39	18.9
Middle-Late	M	0	0	0	0	1	0	1	2	0	0	0	0	4	1.9
	F	0	0	0	0	0	0	0	4	0	0	0	0	4	1.9
	?	0	6	1	0	0	0	0	0	0	0	1	0	8	3.9
Middle	M	0	0	0	0	0	0	4	5	1	0	0	0	10	4.8
	F	0	0	0	0	2	1	8	6	1	0	0	0	18	8.7
	?	1	9	4	4	2	0	1	1	0	0	1	0	23	11.2
Early-Middle	M	0	0	0	0	0	0	0	2	1	0	0	0	3	1.5
	F	0	0	0	0	0	0	0	1	0	0	0	0	1	0.5
	?	0	0	0	0	0	0	0	0	0	0	0	1	1	0.5
Early	M	0	0	0	0	0	0	1	1	3	0	0	0	5	2.4
	F	0	0	0	0	0	0	2	2	2	0	1	0	7	3.4
	?	0	5	3	0	1	0	0	2	0	0	1	0	12	5.8
Unknown	?	0	6	2	1	0	0	3	5	0	0	1	3	21	10.2
Totals (M + F + ?)		3	50	14	8	10	2	33	59	16	0	6	5	206	
Percent		1.5	24.3	6.8	3.9	4.8	1.0	16.0	28.6	7.8	0.0	2.9	2.4		99.9

*Table cannot economically indicate qualitative aspect, and therefore does not include 84 cremations whose age and sex estimates must be viewed with generally less certainty.

Table 55.
Quantitative summary of Gran Quivira cremations.

Age	Male	Female	Sex ?	Number	Totals Percent
Fetal <0 years	0	0	0	0	0.0
Infant 0-3 years	0	0	7	7	8.3
Child 4-6 years	0	0	7	7	8.3
Child 7-12 years	0	0	3	3	3.6
Adolescent 13-17 years	0	0	0	0	0.0
Sub-adult 18-20 years	0	0	0	0	0.0
Young adult 21-35 years	3	5	9	17	20.2
Middle age 36-55 years	2	2	5	9	10.7
Old adult 56-75 years	0	0	0	0	0.0
Senile >75	0	0	0	0	0.0
Adult age ?	1	3	22	26	30.9
Age ?	0	0	15	15	17.9
Totals Number	6	10	68	84	
Percent	7.1	11.9	80.9		99.9

*Cremations are exclusively from the Late Phase occupation.

Table 56.
Age class and corresponding age in years.

Class	Age in Years	Class	Age in Years
0	Fetal	5	18-20
1	x-3	6	21-35
2	4-6	7	36-55
3	7-12	8	56-75
4	13-17	9	76-x

Table 57.
Distribution of mandibular torus grades by sex,
(older than age 13).

Torus Grade	Males	Females	Sex ?	Total
0	6	12	9	27
1	11	19	4	34
2	9	17	6	32
3	10	8	5	23
4	3	1	1	5
Total	39	57	25	121

Table 58.
Distribution of torus grades by age class, sex, and phase
(older than age 13).

Period	Age	Males					Females					Sex Unknown				
		0	1	2	3	4	0	1	2	3	4	0	1	2	3	4
Early	13-17	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	18-20	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	21-35	–	1	–	–	–	1	1	–	–	–	–	–	–	–	–
	36-55	–	1	–	1	–	1	1	–	1	–	–	–	–	–	–
	56-75	1	–	–	1	1	1	–	–	–	–	–	–	–	–	–
Middle	13-17	–	–	–	–	–	1	1	–	–	–	2	–	–	–	–
	18-20	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–
	21-35	1	–	2	–	–	3	3	2	1	–	–	–	–	–	–
	36-55	–	–	1	2	1	1	1	3	–	–	1	–	–	–	–
	56-75	1	1	1	–	–	–	–	–	1	–	–	–	–	–	–
Late	13-17	–	1	–	–	–	–	–	1	–	–	2	–	–	–	–
	18-20	–	1	–	–	–	–	1	–	–	–	–	–	–	–	–
	21-35	–	–	–	1	–	–	6	5	2	–	–	–	–	–	–
	36-55	3	6	3	5	1	3	4	4	1	–	–	–	–	–	–
	56-75	–	–	1	–	–	–	–	–	2	–	–	–	–	–	–
	?	–	–	–	–	–	–	–	–	–	–	3	3	4	4	–
Phase ?	13-17	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	18-20	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	21-35	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–
	36-55	–	–	1	–	–	1	–	–	–	1	–	–	1	–	–
	56-75	–	–	–	–	–	–	–	1	–	–	–	–	–	–	1
	?	–	–	–	–	–	–	–	–	–	–	1	1	1	1	–

Table 59.
Frequency of each grade of torus compared for males and females
(older than age 13).

Torus Grade	Number	Males Frequency	Number	Females Frequency
Grade 0	6/39	15.4%	12/57	21.1%
Grade 1	11/39	28.2%	19/57	33.3%
Grade 2	9/39	23.1%	17/57	29.8%
Grade 3	10/39	25.6%	8/57	14.0%
Grade 4	3/39	7.7%	1/57	1.8%

Table 60.
Comparison between age classes of presence and absence
of torus in males.

Age Class	Group	Grades 1, 2, 3, 4	Grade 0	N	X^2	P
6	21-35 years	4	1	5		
7	36-55 years	22	3	25	0.27*	0.3
8	56-75 years	5	2	7		

*Yates correction factor used.

Table 61.
Comparison between age classes of presence and absence
of torus in females.

Age Class	Group	Grades 1, 2, 3, 4	Grade 0	N	X^2	P
6	21-35 years	21	4	25		
7	36-55 years	16	5	21	1.33*	0.5
8	56-75 years	4	2	6		

*Yates correction factor used.

Table 62.
Comparison of cremations and inhumations in the Late Phase for presence and absence of torus, pooled sample (older than age 13).

Group	Presence Torus Grades 1-4	Absence Torus Grade 0	N	X^2	P
Cremations	11	3	14	0.31*	0.7
Inhumations	45	8	53	–	–

*Yates correction factor used.

Table 63.
Comparison of presence and absence of torus for males between time periods.

Time Period	Grades 1, 2, 3, 4	Grade 0	N	X^2	P
Early and Middle	13	3	16	0.34*	0.5
Late	19	3	22	–	–
Early	5	1	6	0.34*	0.5
Middle and Late	27	5	32	–	–
Early	5	1	6	0.37*	0.5
Late	19	3	22	–	–

*Yates correction factor used.

Table 64.
Comparison of presence and absence of torus for females between time periods.

Time Period	Grades 1, 2, 3, 4	Grade 0	N	X^2	P
Early and Middle	16	8	24	4.26*	0.025
Late	26	3	29	–	–
Early	4	3	7	1.96*	0.2
Middle and Late	38	8	46	–	–
Early	4	3	7	3.79*	0.05
Late	26	3	29	–	–

*Yates correction factor used.

Table 65.
Comparison of presence and absence of torus between sexes, Early Phase (older than age 13).

Sex	Presence Grades 1, 2, 3, 4	Absence Grade 0	N	X^2	P
Males	5	1	6	1.22*	0.3
Females	4	3	7	–	–

*Yates correction factor used.

Table 66.
Comparison of presence and absence of torus between sexes, Middle Phase (older than age 13).

Sex	Presence Grades 1, 2, 3, 4	Absence Grade 0	N	X^2	P
Males	9	2	10	0.21*	0.7
Females	13	5	18	–	–

*Yates correction factor used.

Table 67.
Comparison of presence and absence of torus between sexes, Late Phase (older than age 13).

Sex	Presence Grades 1, 2, 3, 4	Absence Grade 0	N	X^2	P
Males	19	3	22	0.29*	0.6
Females	26	3	29	–	–

*Yates correction factor used.

Table 68.
Asymmetry of torus grades for males and females.

Sex	Number	Torus Grade Left	Right	Sex	Number	Torus Grade Left	Right
Males	1	0	2*	Males	2	1*	0
	1	0	2*		1	2*	1
	6	1	2*		1	3*	2
	3	1	3*		–	–	–
	2	2	3*		–	–	–
Females	5	0	1*	Females	1	1*	0
	7	1	2*		3	2*	1
	1	1	3*		1	3*	0
	1	2	3*		–	–	–
	1	0	4*		–	–	–

*Denotes the larger torus development.

Table 69.
Goodness-of-fit test, Combining Males, Females, and Sex Unknown (Older than age 13).

Number	pp	pq	qq	N	X^2	p
	Grade 0	Grade 1	Grades 2, 3, 4			
Observed	27	34	60	121	–	–
Expected	16.0	55.9	49.0	–	18.6	0.01
	Grade 0	Grades 1, 2	Grades 3, 4			
Observed	27	66	28	121	–	–
Expected	29.7	60.5	30.8	–	1.004	0.3
	Grade 0	Grades 1, 2, 3	Grade 4			
Observed	27	89	5	121	–	–
Expected	42.2	58.5	20.24	–	32.9	0.01
	Grades 0, 1	Grade 2	Grades 3, 4			
Observed	61	32	28	121	–	–
Expected	48.9	56.0	16.0	–	22.2	0.01
	Grades 0, 1	Grades 2, 3	Grade 4			
Observed	61	55	5	121	–	–
Expected	64.7	47.5	8.7	–	14.2	0.01
	Grades 0, 1, 2	Grade 3	Grade 4			
Observed	93	23	5	121	–	–
Expected	90.2	28.5	2.3	–	4.5	0.025

Table 70.
Comparison of torus frequency at Gran Quivira with Arctic data* all grades pooled (older than age 13).

Group	Males	Females	Pooled	Percent
Sadlermuit Eskimo	3/3	31/36	34/39	87.2
Western Aleuts	6/10	6/7	12/17	82.8
Gran Quivira	33/39	45/57	78/96	81.3
Eastern Aleuts	6/8	1/2	7/10	73.3
Central Aleuts	9/11	2/4	11/15	70.6
Arctic Eskimo	2/3	0/0	2/3	66.6
Greenland Eskimo	5/7	23/38	28/45	62.2
Kodiak Eskimo	7/10	4/9	11/49	57.9
Southeastern Alaska Indians	1/2	1/3	2/5	40.0
Arctic Indians	2/2	1/7	3/9	33.3

*Turner and Becker, 1968.

Table 71.
Comparison of torus frequency at Gran Quivira with other American Indian groups (older than age 13).

Group	Males	Females	Pooled	Percent
Gran Quivira (Grades 1, 2, 3, 4)	33/39	45/57	78/96	81.3
Gran Quivira (Grades 2, 3, 4)	22/39	26/57	48/96	50.0
Kentucky†	134/263	100/199	234/462	52.8
Pueblos*	67/245	61/281	128/526	24.3
Kentucky*	13/50	6/32	19/82	23.1
Arkansas and Louisiana*	26/145	8/106	34/251	13.6
California*	25/188	22/222	47/410	11.5
Sioux*	5/37	2/33	7/70	10.0
Potomac River*	8/95	6/69	14/164	8.5
Florida*	13/272	9/225	22/497	4.4

*After Hrdlicka, 1940.
†After Snow, 1948.

Table 72.
Comparison of torus frequency at Gran Quivira and Hopi, pooled sample* (older than age 13).

Group	Grades 1, 2, 3, 4	Grade 0	N	X^2	P
Gran Quivira	77	18	95	26.2	0.01
Hopi	33	61	94	–	–

*Pooled for male, female, and sex unknown individuals.

Table 73.
Gran Quivira sample used in stature reconstruction by age, sex, and time period.

					Age Categories	
Time Period	Sex	18-20	21-35	36-55	56-75	Totals
Early (A.D. 1315-1400)	M	0	1	1	3	5
	F	1	2	2	2	7
Early-Middle	M	0	0	2	1	3
	F	0	0	1	0	1
Middle (A.D. 1400-1550)	M	0	4	4	1	9
	F	1	9	4	1	15
Late-Middle	M	0	1	2	0	3
	F	0	0	4	0	4
Late (A.D. 1550-1672)	M	0	0	12	2	14
	F	0	12	9	6	27
Totals	M	0	6	21	7	34
	F	2	23	20	9	54*

*One adult female, age unknown, was examined, but is not included in the table.

Table 74.
Values of variance (s^2) that measure the relative reliability of the three sets of stature formulas when applied to Southwest Indian skeletal series.

Population	Sex	Genovés	Trotter & Gleser	Pearson
Gran Quivira	M	2.43	5.05	8.65
	F	1.55	9.02	4.46
Pecos	M	0.44	1.23	3.51
	F	2.09	7.68	3.36
Point of Pines	M	1.53	4.24	7.16
	F	1.14	9.96	4.65
Average variance	M	1.47	3.51	6.44
	F	1.59	8.89	4.16

Table 75.
Data on maximum long bone length by sex and time period (all figures in mm.).

Period	Bones	Sex	No.	x	s	sx	Range
Early	Femur	M	6	418.0	28.21	11.52	387-448
		F	7	388.9	15.65	5.91	374-418
	Tibia	M	5	364.0	16.55	7.40	339-381
		F	8	319.5	20.78	7.35	282-354
	Fibula	M	4	349.0	14.94	7.47	332-368
		F	7	305.0	14.12	5.34	277-320
	Humerus	M	6	306.0	14.83	6.06	285-325
		F	6	274.8	14.09	5.75	248-289
	Radius	M	6	247.5	7.50	3.06	235-257
		F	7	212.6	5.62	2.13	203-219
	Ulna	M	6	264.3	6.71	2.74	254-273
		F	7	226.0	12.54	4.74	201-235
Middle	Femur	M	8	429.4	18.92	6.69	400-453
		F	15	399.7	16.70	4.31	375-424
	Tibia	M	10	369.9	11.97	3.78	343-379
		F	12	334.8	18.85	5.44	313-366
	Fibula	M	5	359.4	14.54	6.50	335-371
		F	10	325.7	18.39	5.82	305-359
	Humerus	M	9	312.2	15.61	5.20	286-325
		F	17	289.5	12.73	3.09	265-306
	Radius	M	9	242.8	8.39	2.80	299-252
		F	14	223.4	10.83	2.89	206-245
	Ulna	M	8	261.1	9.33	3.30	250-276
		F	16	238.8	11.34	2.84	222-258
Late	Femur	M	11	427.0	15.90	4.79	397-454
		F	21	402.9	13.94	3.04	368-428
	Tibia	M	10	364.3	13.60	4.30	342-385
		F	22	334.7	16.71	3.56	300-363
	Fibula	M	8	352.3	10.42	3.68	337-369
		F	19	326.6	17.53	4.02	290-357
	Humerus	M	11	307.0	8.88	2.68	295-320
		F	24	286.1	13.14	2.68	251-320
	Radius	M	13	241.8	7.91	2.19	231-256
		F	23	219.9	9.93	2.07	198-237
	Ulna	M	8	257.5	7.25	2.56	247-269
		F	22	236.3	9.81	2.09	214-251

Table 76.
Data on maximum long bone length (in mm.) for Gran Quivira, Pecos*, and Point of Pines†.

Bone	Population	Sex	No.	x	s	sx	Range	C.V.
Femur	Gran Quivira	M	25	425.6	19.03	3.81	387-454	4.47
		F	43	399.5	15.64	2.39	368-428	3.91
	Pecos	M	142	427.0	20.05	1.14	383-463	4.70
		F	105	395.2	17.25	1.15	356-446	4.37
	Point of Pines	M	86	428.4				
		F	90	400.8				
Tibia	Gran Quivira	M	25	366.5	13.29	2.66	399-385	3.63
		F	42	331.8	18.67	2.80	282-366	5.63
	Pecos	M	130	357.7	19.15	1.16	311-415	5.35
		F	90	325.6	15.22	1.11	285-369	4.66
	Point of Pines	M	71	368.7				
		F	75	337.2				
Fibula	Gran Quivira	M	17	353.6	12.84	3.12	332-371	3.63
		F	36	322.2	18.77	3.13	277-359	5.83
	Pecos	M	86	351.2	18.80	1.42	306-391	5.35
		F	44	320.5	14.05	1.47	280-360	4.38
	Point of Pines	M						
		F						
Humerus	Gran Quivira	M	26	308.6	12.68	2.49	285-325	4.11
		F	47	285.9	13.60	1.98	248-320	4.76
	Pecos	M	134	309.2	15.05	0.89	263-358	4.86
		F	96	287.1	12.82	0.91	254-325	4.47
	Point of Pines	M	88	309.3				
		F	93	287.8				
Radius	Gran Quivira	M	28	243.3	8.01	1.51	229-257	3.29
		F	44	219.8	10.59	1.60	198-245	4.82
	Pecos	M	100	238.9	13.20	0.92	200-270	5.52
		F	68	218.1	10.73	0.92	190-241	4.92
	Point of Pines	M	60	239.5				
		F	60	220.0				
Ulna	Gran Quivira	M	22	260.7	8.06	1.72	247-276	3.09
		F	45	235.6	11.04	1.65	201-262	4.69
	Pecos	M	87	256.8	11.88	0.87	223-284	4.62
		F	51	236.0	11.64	1.14	209-264	4.93
	Point of Pines	M	54	258.5				
		F	51	239.7				

*After Hooton, 1930.
†After K. A. Bennett, 1967b.

Table 77.
Stature estimates (in cm.) of Gran Quivira males and females derived by using the formulae of Genovés (1967), Trotter-Gleser (1952, 1958), and Pearson (1899).

Formula	Period	Sex	No.	$\bar{x}$	s	s_x	Range
Genovés	Middle	M	12	162.7	3.71	1.07	154.3-165.5
		F	19	152.7	4.50	1.03	146.4-160.8
	Late	M	14	162.2	2.53	0.68	158.3-166.7
		F	27	152.7	4.17	0.80	142.9-160.0
	Totals	M	34	162.4	3.33	0.58	153.8-166.7
		F	55	152.0	4.68	0.63	138.0-160.8
Trotter-Gleser	Early	M	8	164.3	5.72	2.02	156.2-170.6
		F	9	150.9	5.90	1.97	139.9-162.4
	Middle	M	12	167.1	4.58	1.32	157.7-172.7
		F	19	155.2	5.20	1.19	147.9-165.4
	Late	M	14	165.0	3.39	0.90	159.3-171.0
		F	27	155.2	4.35	0.84	143.7-162.6
	Totals	M	34	165.6	4.46	0.77	156.2-172.7
		F	55	154.5	5.08	0.69	139.9-165.4
Pearson	Early	M	8	161.9	5.36	1.89	153.2-168.4
		F	9	148.3	4.18	1.39	141.1-156.1
	Middle	M	12	163.9	4.52	1.31	156.5-168.7
		F	19	151.9	3.74	0.86	145.8-159.1
	Late	M	14	161.9	3.29	0.88	156.3-167.7
		F	27	151.8	3.48	0.67	145.3-158.4
	Totals	M	34	162.6	4.25	0.73	153.2-168.7
		F	55	151.2	3.85	0.52	141.1-159.1

Table 78.
Frequencies of traits in lower first premolars (percent).

Categories	♂ (*N* = 8 teeth)	♀ (*N* = 23 teeth)	♂ + ♀ + ? (*N* = 35 teeth)
No external lingual groove	62.50	56.52	57.14
One external lingual groove	25.00	21.73	25.71
Two external lingual grooves	12.50	21.73	17.14
Interrupted sagittal sulcus	100.00	82.60	88.57
Uninterrupted sagittal sulcus	0.00	17.39	88.57
Mesial deuteroconid	25.00	23.80	33.33
Distal deuteroconid	0.00	19.04	12.12
Medial deuteroconid	75.00	57.14	54.54
One lingual cusp	75.00	86.95	80.00
Two lingual cusps	25.00	13.04	20.00
Single occlusal ridge, protoconid	100.00	73.91	77.14
Divergent occlusal ridge, protoconid	0.00	26.08	22.85
One occlusal pit	25.00	65.69	56.25
Two occlusal pits	75.00	34.31	43.75
Fused protoconid and deuteroconid	100.00	78.26	85.71
Independent protoconid and deuteroconid	0.00	21.73	14.28

Table 79.
Symmetry in first lower premolars (percent).

Categories	♂ (*N* = 4 individuals)	♀ (*N* = 11 individuals)	♂ + ♀ + ? (*N* = 16 individuals)
External lingual grooves	50.00	63.63	56.25
Sagittal sulcus	100.00	90.90	87.50
Relative position to the deuteroconid	50.00	81.81	68.75
Number of lingual cusps	75.00	100.00	87.50
Occlusal ridge of the protoconid	100.00	100.00	93.75
Number of occlusal pits	50.00	81.81	68.75
Deuteroconid-protoconid relationship	100.00	81.81	81.25

Table 80.
Incidence of three-rooted mandibular first molars in American Indian and arctic populations.

Population	Males		Females		Sexes Pooled		Reference
	No.	%	No.	%	No.	%	
Aleuts	26/46	56.52	5/21	23.81	38/87	43.68	Turner (Part 8)
Eskimos	11/33	33.33	15/64	23.44	31/116	26.72	Turner (Part 8)
Eskimos (Eastern Greenland)	–	–	–	–	8/64*	12.50	Pedersen (1949)
Arctic and Northwestern Coast Indians	0/10	0.00	1/24	4.17	4/41	0.76	Turner (Part 8)
California Indians	39/615	6.34		23/394	79/1205	6.56	Turner (Part 8)
Nevada Indians	1/17	5.88	0/6	0.00	1/30	3.33	Turner (Part 8)
Hopewell focus Indians	0/5	0.00	0/4	0.00	0/10	0.00	Turner (Part 8)
Peruvian Indians	4/129	3.10	1/42	2.38	7/191	3.66	Turner (Part 8)
Pecos Pueblo	–	–	–	–	0/72*	0.00	Nelson (1938)
Gran Quivira	2/24	8.33	1/31	3.23	4/69†	5.80	this study

*Tooth count.
†Includes individuals of undetermined sex.

Table 81.
Incidence of mandibular and palatine tori in the Gran Quivira population, by age and sex.

	Manidibular Torus (individuals older than age 18)								Palatine Torus (individuals older than age 18)							
	Males		Females		Sex Unknown		Totals		Males		Females		Sex Unknown		Totals	
Time	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Adults																
Early Phase A.D. 1315–1400	6/8	75.0	3/5	60.0	1/1	100.0	10/14		2/3	66.7	3/5	60.0	1/1	100.0	6/9	
Middle Phase A.D. 1400–1550	12/12	100.0	12/17	70.6	0/1	0.0	24/30		9/12	75.0	8/15	53.3	1/1	100.0	18/26	
Late Phase A.D. 1550–1672	15/18	83.3	22/24	91.7	2/3	66.7	39/45		13/17	76.5	10/19	52.6	0/1	0.0	23/37	
Cremations A.D. 1550–1672	1/2	50.0	3/3	100.0	11/13	84.6	15/18		–	–	–	–	–	–	–	
Time Unknown	1/2	50.0	1/3	33.3	2/2	100.0	4/7		–	–	1/1	100.0	0/1	0.0	1/2	
Frequency (%)		83.3		78.8		80.0				75.0		55.0		50.0		
Totals	35/42		41/52		16/20		92/114		24/32		22/40		2/4		48/76	
Subadults (younger than age 18)																
Early Phase	–	–	–	–	2/4	50.0	2/4		–	–	–	–	1/4	25.0	1/4	
Middle Phase	1/1	100.0	2/2	100.0	4/12	33.3	7/15		0/1	0.0	2/2	100.0	6/11	54.5	8/14	
Late Phase	1/1	100.0	1/1	100.0	8/16	50.0	10/18		1/1	100.0	1/2	50.0	8/17	47.1	10/20	
Time Unknown	–	–	–	–	1/4	25.0	1/4		–	–	–	–	1/2	50.0	1/2	
Frequency (%)		100.0		100.0		43.2				50.0		75.0		47.1		
Totals	2/2		3/3		15/36		20/41		1/2		3/4		16/34		20/40	
Totals (adults + subadults)	37/44	84.1	44/55	80.0	31/56	56.1	112/155	72.4	25/34	73.5	25/44	56.8	18/38	47.4	68/116	58.6

Table 82.
Incidence of mandibular and palatine tori in various American Indian and Japanese populations.

	Mandibular Torus						Palatine Torus						
	Males		Females		Sex Unknown		Males		Females		Sex Unknown		
Population	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	Reference
Gran Quivira*	33/38	86.8	35/44	79.6	75/91	82.4	24/32	75.0	22/40	55.0	48/75	64.0	This study
Pecos Pueblo	97/142	68.3	65/111	58.6	162/253	64.0	17/142	12.0	15/111	13.5	32/253	12.7	Hooten (1930)
Eastern Aleuts	16/22	72.7	11/22	50.0	27/44	61.4						0.0	Moorrees (1957)
Western Aleuts	6/17	35.3	3/18	16.7	9/35	25.7						0.0	Moorrees (1957)
All Aleuts	24/57	42.1	14/51	27.5	38/108	35.2					0/108	0.0	Moorrees (1957)
Vancouver, British Columbia					0/100	0.0					1/50	2.0	Berry and Berry (1967)
Peru					0/106	0.0					0/53	0.0	Berry and Berry (1967)
Chiggerville, Kentucky					3/70	4.3					1/70	1.4	Skarland (1939)
Peru					16/455	3/5					65/211	30.8	Hrdlicka (1940)
Madisonville, Ohio							4/33	12.1	4/20	20.0	8/53	15.1	Hooten (1920)
Oklahoma Archaic					6/52	11.5					3/25	12.0	McWilliams (1969)
Indian Knoll, Kentucky	134/263	51.0	100/199	50.3	234/462	50.7	150/234	64.1	49/87	56.3	199/321	62.0	Snow (1948)
Pickwick Basin Shellmound, Alabama	10/19	52.6	8/13	61.5	18/32	56.3	7/22	31.8	4/18	22.2	11/40	27.5	M.T. Newman and Snow (1942)
Japanese					58/185	31.4	69/158	43.7	84/197	42.6	153/355	43.1	palatine torus, Akabori (1939); mandibular torus, Suzuki and sakai (1960)

*Adults (older than age 18).

Table 83.
Individuals from Gran Quivira used in studies of vertebral column.

Age at Death (in years)	Early Phase			Middle Phase			Late Phase			Period Unknown			Totals
	♂	♀	?	♂	♀	?	♂	♀	?	♂	♀	?	
4–6	0	0	2	0	0	3	0	0	3	0	0	2	10
7–12	0	0	0	0	0	1	0	0	2	0	0	0	3
13–17	0	0	0	0	0	7	0	0	2	0	0	0	9
18–20	0	0	0	0	0	1	0	0	1	0	0	0	2
21–35	1	2	0	5	6	1	0	12	0	0	1	0	28
36–55	3	3	0	6	10	1	13	8	0	0	1	0	45
56–75	3	1	0	1	1	0	2	6	0	0	0	0	14
Totals	7	6	2	12	17	14	15	26	8	0	2	2	111

Table 84.
Reference scale for degree of vertebral column pathology.

Value	Degree	Specimen No.	Vertebra	Disease
0	none	149 body	C-3, L-3	Osteophytosis
		65 facets	T-6	Osteoarthritis
1	slight	281 body	T-3	Osteophytosis
		281 facets	L-3	Osteoarthritis
2	moderate	292 body	T-12	Osteophytosis
		281 facets	T-8	Osteoarthritis
3	pronounced	292 body	T-3, L-1	Osteophytosis
		76 facets	L-5	Osteoarthritis
[4]	fused	64 –	T-4, T-5	–

Table 85.
Numbers of pre-sacral vertebrae (PSV) found among Gran Quivirans as compared with other populations.

Population	23 PSV	24 PSV	25 PSV	No.
Mongoloids*				
♂	4 (2.9%)	116 (85.3%)	16 (11.8%)	136
♀	3 (3.1%)	91 (92.9%)	4 (4.1%)	98
Caucasoids*				
♂	11 (4.2%)	235 (89.4%)	17 (6.5%)	263
♀	13 (5.8%)	203 (90.2%)	9 (4.0%)	225
Negroids*				
♂	12 (4.8%)	225 (90.7%)	11 (4.4%)	248
♀	31 (11.5%)	233 (86.6%)	5 (1.9%)	269
Case-Western Reserve Medical School Museum (presumably mostly American Whites)†	1.5%	94.4%	4.1%	1,471
East Africans‡	3.4%	85%	11.6%	206
Eskimos§	0.0%	88%	12%	216
Gran Quivirans#				
♂	1 (10.0%)	9 (90.0%)	0	10
♀	0	19 (95.0%)	1 (5.0%)	20
♂ + ♀ + ?	1 (2.6%)	36 (94.7%)	1 (2.6%)	38

*After Bornstein and Peterson, 1966, p. 142.
†After Willis, 1929, p. 164.
‡After Allbrook, 1955, p. 491.
§After Stewart, 1932, p. 126.
#This study.

Table 86.
Double cervical foramina transversarium.

	Juveniles–Sex Unknown		Adult Males		Adult Females	
	%	No.	%	No.	%	No.
C-1						
Left	0.0	0/16	4.8	1/21	7.1	2/28
Right	6.3	1/16	20.0	4/20	3.4	1/29
C-2						
Left	0.0	0/16	0.0	0/25	0.0	0/34
Right	0.0	0/16	0.0	0/25	0.0	0/34
C-3						
Left	0.0	0/14	0.0	0/25	0.0	0/33
Right	0.0	0/14	0.0	0/25	1.5	1/33
C-4						
Left	16.6	2/12	4.2	1/24	3.3	1/30
Right	0.0	0/12	8.3	2/24	6.7	2/30
C-5						
Left	18.8	3/16	24.0	6/25	17.1	6/35
Right	6.3	1/16	42.3	11/26	34.3	12/35
C-6						
Left	61.5	8/13	50.0	9/18	62.5	20/32
Right	46.2	6/13	55.5	10/18	56.3	18/32
C-7						
Left	28.6	4/14	36.4	8/22	46.9	15/32
Right	35.7	5/14	34.8	8/23	40.6	13/32

Table 87.
Bifid cervical spines among Gran Quivirans and other populations.

	Percent Cleft					
Population	C-2	C-3	C-4	C-5	C-6	Number
USA White males*	–	77	85	90	77	87
Chinese males*	–	83	89	77	29	98-100
USA Negro males*	–	15	32	52	35	87-90
Illinois Indians*	–	37	75	76	31	16-19
East Africans†	89	41	57	72	46	206
Gran Quiviran adult males‡	96	96	76	75	39	18-25
Gran Quiviran adult females‡	94	66	81	90	57	26-37

*After Post, 1966, p. 345.
†After Allbrook, 1955, p. 493.
‡Present study.

Table 88.
Bifid sacral spines among Gran Quivirans.

	Percent Bifid					
	S-1	S-2	S-3	S-4	S-5	Number
Adult males	9.5	4.7	0.0	47.6	100	21
Adult females	10.0	3.3	3.3	30.0	100	30
Adolescents	33.0	0.0	33.0	50.0	100	6

Table 89.
Compression fractures among Gran Quivirans.

	♂		♀		♂ + ♀ + ?	
Site of Fracture	%	No.	%	No.	%	No.
T-11	0.0	0/25	2.6	1/38	1.6	1/63
T-12	0.0	0/26	5.1	2/39	3.1	2/65
L-1	3.5	1/28	0.0	0/41	1/4	1/69
L-2	4.2	1/24	0.0	0/39	1.6	1/63
L-3	0.0	0/18	2.5	1/40	1.7	1/58

Table 90.
Means of the metrical features of the face and mandible of both Middle and Late populations. Note: all measurements in mm.

Males	Middle x	Late x	"T"
Significant			
Total facial height	129.0	122.0	4.14
Biorbital breadth	99.3	95.3	2.20
Maximum alveolar length	53.0	50.1	2.30
Symphyseal height	36.3	33.8	2.27
Height ascending ramus	69.6	66.6	2.30
Insignificant			
Upper facial height	75.1	71.2	1.83
Bixygomatic breadth	141.1	134.1	2.06
Nasion-basion	102.6	100.3	1.25
Alveolar-basion	97.0	95.7	0.86
Orbital breadth	38.3	38.4	0.18
Orbital height	36.0	36.1	0.91
Inter-orbital breadth	14.1	14.3	0.19
Nasal breadth	26.0	25.9	0.13
Nasal height	52.3	51.0	0.64
Maximum alveolar br.	66.5	63.2	1.02
Mandibular length	106.2	108.0	0.77
Bicondylar breadth	119.2	118.2	0.27
Bigonial breadth	100.8	100.0	0.30
Minimum br. of ramus	36.1	34.8	1.17
Incisural breadth	36.0	37.4	0.89
Incisural depth	14.0	14.4	0.43

Females	Middle x	Late x	"T"
Significant			
Minimum breadth of ramus	33.2	35.1	2.05
Incisural breadth	36.7	39.1	2.39
Insignificant			
Total facial height	114.0	113.0	0.34
Biorbital breadth	91.8	92.1	0.16
Maximum alveolar length	49.0	50.4	1.05
Height ascending ramus	61.1	64.2	1.96
Upper facial height	68.6	66.6	1.69
Byzygomatic breadth	130.2	128.7	0.60
Nasion-basion	94.0	95.9	1.04
Alveolar-basion	91.7	92.4	0.41
Orbital breadth	37.4	37.4	0.00
Orbital height	35.4	35.0	0.59
Inter-orbital breadth	13.9	14.0	0.10
Nasal breadth	25.6	24.5	1.71
Nasal height	48.3	47.7	0.61
Maximum alveolar breadth	61.5	61.6	0.10
Mandibular length	100.0	102.3	0.96
Bicondylar breadth	113.1	113.2	0.04
Bigonial breadth	90.8	92.9	0.84
Symphyseal height	32.6	33.6	1.07
Incisural depth	12.5	13.0	1.25

Table 91.
Male means for four Southwest skeletal series, plus other Gran Quivira statistical measures. Note: all measurements in mm.

					Gran Quivira (Middle and Late)				
Measurements	Pecos x	Paako x	Swarts Ruin x	Point of Pines x	No.	x	S.D.	S.E.	Range
Upper facial height	72.85	68.75	71.60	70.20	17	72.8	4.69	1.14	65-80
Total facial height	119.38	114.37	116.43	118.00	12	124.3	6.14	1.77	111-132
Max. bizygomatic br.	138.56	133.00	133.50	134.00	15	137.4	6.17	1.72	127-146
Nasion-basion	101.89	95.47	98.50	99.20	11	101.3	3.04	0.91	96-105
Alveolar-basion	97.80	92.89	101.00	97.00	11	96.3	5.21	1.57	93-101
Biorbital breadth	–	–	–	97.20	16	97.1	4.28	1.03	89-103
Inter-orbital breadth	–	–	–	–	22	14.2	2.50	0.53	9-19
Orbital breadth	39.90	38.25	40.00	37.60	17	38.4	1.53	0.37	36-40
Orbital height	34.80	34.63	34.96	35.50	17	36.1	1.23	0.30	34-40
Nasal breadth	25.80	25.55	27.31	25.00	21	25.9	1.74	0.38	24-29
Nasal height	50.96	49.10	49.67	49.80	19	51.6	3.07	0.70	47-58
Alveolar breadth	65.59	62.60	66.18	64.70	11	65.0	3.84	1.46	58-71
Alveolar length	55.04	51.50	55.92	55.10	16	51.2	3.09	0.77	46-55
Mandibular length	–	–	105.80	102.00	12	107.3	3.72	1.07	101-114
Bicoyndylar breadth	122.34	117.86	118.00	123.30	12	118.7	6.31	1.82	105-128
Bigonial breadth	101.56	97.79	97.10	102.40	19	100.4	5.56	1.27	90-110
Symphseal height	35.40	32.56	35.00	34.80	17	34.8	2.37	0.57	31-40
Height ascending ramus	62.83	59.27	60.77	58.40	16	68.7	3.84	0.96	65-73
Minimum breadth ramus	36.92	35.93	35.80	32.80	22	35.4	2.64	0.56	30-41

Table 92.
Female means of four Southwest skeletal series plus other Gran Quivira statistical measures. Note: all measurements in mm.

Measurement	Pecos x	Paako x	Swarts Ruin x	Point of Pines x	Gran Quivira (Middle and Late) No.	x	S.D.	S.E.	Range
Upper facial height	69.04	62.50	66.25	66.6	17	67.5	2.80	0.60	61–72
Total facial height	113.31	98.00	110.00	109.9	16	113.4	5.20	1.30	104–125
Maximum bizygomatic br.	129.87	119.20	128.00	124.9	15	129.3	3.45	0.89	125–133
Nasion-basion	97.31	88.40	97.20	95.1	10	95.3	3.30	1.04	90–101
Alveolar-basion len.	95.05	88.20	97.75	93.8	10	92.2	2.35	0.74	89–95
Biorbital breadth	–	–	–	93.8	15	92.0	3.34	0.86	85–98
Inter-orbital breadth	–	–	–	–	19	14.0	1.80	0.41	9–18
Orbital breadth	38.49	36.50	39.38	36.7	18	37.4	1.02	0.24	36–40
Orbital height	34.22	33.33	33.33	35.2	17	35.2	1.31	0.31	34–49
Nasal breadth	25.33	24.33	24.00	24.6	18	25.0	0.98	0.23	22–27
Nasal height	48.20	44.33	47.70	47.2	17	48.0	1.91	0.46	45–52
Alveolar breadth	62.74	61.17	64.67	61.0	13	61.6	2.79	0.77	59–65
Alveolar length	53.97	48.20	52.00	52.0	16	49.8	2.31	0.58	44–56
Mandibular length	–	–	104.00	99.5	22	101.4	5.55	1.18	92–115
Bicondylar breadth	115.27	102.33	122.00	116.7	22	113.2	5.53	1.18	100–124
Bigonial breadth	94.47	84.67	93.67	94.2	24	92.1	6.01	1.22	84–106
Symphyseal height	33.65	28.25	33.00	32.9	27	33.2	5.62	1.08	28–37
Height ascending ramus	55.02	49.75	53.60	53.9	25	63.1	3.46	0.69	56–68
Minimum breadth of ramus	35.75	31.25	32.86	31.4	25	34.2	2.72	0.49	31–40

Table 93.
Coefficient of Divergence (C.D.) of males and females of Gran Quivira, Pecos, Paako, Swarts Ruin, and Point of Pines.

Population	Males	Females
Gran Quivira vs. Pecos	0.0199	0.0228
Gran Quivira vs. Point of Pines	0.0262	0.0232
Pecos vs. Point of Pines	0.0209	0.0207
Gran Quivira vs. Paako	0.0305	0.0500
Gran Quivira vs. Swarts Ruin	0.0253	0.0301
Paako vs. Swarts Ruin	0.0230	0.0431

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